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AN EPITOME OF SWEDENBORG'S SCIENCE

BY

FRANK W. VERY, S.B. (Mass. Inst. Tech.)

Member of the American Astronomical Society

In Two Volumes

VOLUME II



2

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AN EPITOME OF SWEDENBORG'S SCIENCE

CHAPTER X

SWEDENBORG AS AN ASTRONOMER—HIS DOCTRINE OF THE ORIGIN OF THE PLANETS FROM THE SUN AND HIS THEORY OF NEW STARS, THAT THEY HERALD THE BIRTH OF NEW WORLDS

PROFESSOR YOUNG in his "General Astronomy" says: "Three different philosophers in the last [eighteenth] century, Swedenborg, Kant and La Place* (only one of them an astronomer), independently proposed essentially the same hypothesis to account for the [planetary] system as we now know it. La Place's theory, as might have been expected from his mathematical and scientific attainments, was the most carefully and reasonably worked out in detail." This seems to the writer inadequate and, to some extent, misleading. For, in the first place, though all of these thinkers predicated a derivation of the planets from the sun, La Place's conception was in some respects a reversal of Swedenborg's, since the latter called for the throwing off from the sun of a nebulous ring and its

* The spelling is Professor Young's. Elsewhere, I have followed the custom of astronomers and speak of the "Laplacian" system of celestial mechanics. Since mathematicians speak of the "Cartesian" system of coördinates, but never of the "decartesian system," I have tried to be consistent in the spelling of the proper name, conforming "DesCartes" to the adjective, and retaining the customary difference in "Laplacian."

expansion outwards and final disruption, whereas La Place concluded that a contracting sun had left nebulous rings behind. And, in the second place, La Place's great work was not, as is so often supposed, an elaboration of the nebular hypothesis, but a treatise on celestial mechanics. The only suggestion of a nebular hypothesis is in a short note at the end of the work, and is attributed by La Place to Buffon, who, however, was acquainted with Swedenborg's work and presumably passed it on with modifications. Kant added the idea of the tidal origin of the moon's recession, which has been extended or virtually rediscovered by Sir George Darwin, though Dr. See contends for a capture theory which would be more in accord with Swedenborg's idea of an original swarm of planets and planetoids arising from the disruption of the primitive ring.

While Swedenborg did not spend his life as a professional astronomer, nor does the fact that he produced the first work on algebra ever printed in the Swedish language make him eminently a mathematician, yet it is hard that the man who studied astronomy under the celebrated Halley and who was the first to publish a method of finding longitudes by the moon, also the first to have correct conceptions as to the meaning of the Galaxy, and the first to publish a genuine workable cosmogony, should be denied the title of astronomer. Surely many who have passed their entire lives in the study of that science have accomplished less notable achievements.

Many writers of eminence have mined and quarried the accumulated riches of Swedenborg's wisdom, not always, nor perhaps generally with revelation of the source of their erudition. Ralph Waldo Emerson took much from Swedenborg's philosophy, but balked at the theology. In making these ideas his own, Emerson beautified them and clothed them with poetry, thereby veiling Swedenborg's clear-cut crystals of scientific truth with mystery. It was Emerson who dubbed

Swedenborg a "mystic,"* but it was Emerson himself who was the mystic, who turned science into art, which was an admirable thing in its way to do, even though in the transformation the logic may have suffered. Lacking the power of Swedenborg's logical mind, Emerson's paraphrasing has had its use in presenting profound truths in a light and attractive garb to those who would not otherwise receive them. But his characterization of Swedenborg as "the mystic" is purely fanciful, for no one could be more clearly rational and free from mystery than this man who takes us into his inmost confidence, whose self-revelation and innocence are equal to his wisdom. We may add in passing: Emerson is true to himself in admitting his indebtedness to these priceless teachings. His recognition is even enthusiastic. Swedenborg is

one of the missouriums and mastodons of literature, he is not to be measured by whole colleges of ordinary students. His stalwart presence would flutter the gowns of an university. Our books are false in being fragmentary. . . . But Swedenborg is systematic and respective of the world in every sentence; all

* Swedenborg occasionally, though very seldom, uses the word "mystical," as in *Arcana Cœlestia* n. 5022, where those who are opposed to spiritual truth and are "so indifferent about it, as scarcely to be willing to hear mention made of what is spiritual," are said to prevent the use of ultimate truth by the spiritual man, "which truth being withdrawn, the spiritual man has no longer the means of defending himself against the merely natural, and in this case injury is done to him; for whatever the spiritual man speaks in such case, merely natural men say they do not perceive it, and likewise that it is not so. And if he only mentions what is internal or spiritual, they either ridicule it or call it mystical."

Here evidently the word "mystical" is used to denote conceptions of spiritual things which are either imperfect or erroneous, and it includes somewhat of opprobrium, being of the nature of an epithet attached to what is spiritual by its opponents, tending to bring the spiritual into discredit. "Mystic" is therefore the name which Swedenborg's enemies and inadequate interpreters have applied to him, hinting that the spiritual man is a victim of hallucination.

the means are orderly given; his faculties work with astronomic punctuality, and this admirable writing is pure from all pertness or egotism. . . . His writings would be a sufficient library to : lonely and athletic student. . . . A colossal soul, he lies vast abroad on his times, uncomprehended by them, and requires a long focal distance to be seen.

In spite of these grandiloquent panegyrics, truth compels us to say that Emerson himself did not really comprehend his subject. Like that of most of his contemporaries, Emerson's reputed belief in immortality and a world of pure spirit is largely sham, and he rejects the most important message of all, which Swedenborg was sent to deliver as "Servant of the Lord Jesus Christ." Emerson draws the line at this. For him, all that lies beyond the grasp of this world's experience is simply "ecstasy," to be rejected by anyone who prides himself on his intelligence. Having thus thrown away the better part of the testimony as unworthy of credence, that which is left of the rest of this eulogy is tainted, and excites a suspicion that it savors of base flattery. Neither has Swedenborg been really apprehended, even though mention is made of his "doctrine of Forms, the doctrine of Series and Degrees, the doctrine of Influx, the doctrine of Correspondence." As to correspondence (which involves the law of the intercourse between heaven and earth) it is confounded with allegory, known of old to the poets, but "Swedenborg first put the fact into a detached and scientific statement," we are told, "because it was habitually present to him, and never not seen. . . . The earth had fed its mankind through five or six millenniums, and they had sciences, religions, philosophies, and yet had failed to see the correspondence of meaning between every part and every other part. And down to this hour, literature has no book in which the symbolism of things is scientifically opened."

Thus far Emerson sees, but no farther. Failing to see the real nature of correspondence, it is small wonder that Emerson

does not recognize that the *Arcana Cœlestia* is this very textbook for which he is searching and complains that Swedenborg's "design of exhibiting such correspondence . . . was narrowed and defeated by the exclusively theologic direction which his inquiries took," and lacking all sympathetic apprehension of this part of the message, it necessarily follows that such a one's account of Swedenborg's religious teaching is a travesty and a total misrepresentation.

There is a Divine Illumination of the interiors of the understanding with those who will to be led by the Lord, and this removes the belittling doubts and misconceptions of the natural sceptic. Swedenborg was thus illuminated and he can guide us to receive in freedom a similar illumination. He can guide us if we are in earnest, but his confidences are sometimes grossly abused.

The philosopher Kant "borrowed" some of Swedenborg's philosophy and tried to cover up his tracks by ridiculing his victim. But he was unable to handle these petty pilferings aright. Kant's "pure reason" is far from pure, and its subtle materialistic bias has infected the whole of German thought.

La Place, great thinker and mathematician, but an out-and-out materialist who had "never had occasion to use the hypothesis that there is a God," was another borrower from Swedenborg, this time of his doctrine that the planets are derived from the sun. In La Place's hands this doctrine assumed the form of a nebulous and shrinking sun, leaving behind nebulous rings which became condensed to planets. La Place's idea has been pretty thoroughly demolished by scientific criticism, but Swedenborg, from whom the suggestion was taken by La Place through the intermediation of Buffon, puts the conception in a different way, and avers that a dark and cooled superficial layer of the sun was separated off by increasing centrifugal force of the sun's rotation and sent out to a progres-

sively increasing distance in a spiral orbit. He adduces in confirmation the phenomena of Tycho Brahe's new star and other similar occurrences.

The number and quantity of finites of the fourth kind increase more and more by reason of the successive compression of the elementaries; and they also become compact round the solar space. The finites thus formed an immense volume, and crowded around and enclosed the sun in such a manner as to form an incrustation. (*Principia*, Part III, Chap. IV, n. 3.) "These finites, deprived of all power of actuating themselves, occupy their place round the sun as mere passives; and arranged round this space they enclose it on every side." (*Ibid.*, n. 2.) "The sun, surrounded with this crust and enclosed in the middle of it, was thus, as it were, in a pregnant state, and ready to introduce something new." (*Ibid.*, n. 3.) "Nevertheless this crust, formed round the sun, and consisting of fourth finites, is carried round by a kind of revolution." (*Ibid.*, n. 4.)

As to the origin of this revolution, Swedenborg is not clear. We have seen that the interiors of the primal particles are self moved, but this self-derived circulation ceases with the atom. The component parts of the crust are "mere passives." Whence, then, comes the revolution? Swedenborg's attempt to bolster up the interplanetary vortex of Des Cartes is a failure. We must seek elsewhere for a sufficient cause for the angular momentum of the solar material. We find it, if we accept the newer hypotheses, that the atoms which have been formed in the gaseous nebulae are aggregated together into meteoritic crystallizations and are attracted into primitive nebular nuclei, and that the smaller meteorites revolve in orbits around the larger centers of aggregation under gravitational force. Soon internal collisions, undergone by individual members of the condensing swarm, generate central heat which continually mounts, and intercollision of meteoritic and orbitally revolving particles is found to account for a resultant angular momentum.

We therefore predicate:

- (1) A gaseous nebula where atoms are evolving.
- (2) Aggregation of atoms to form meteoritic crystals.
- (3) Further aggregation and orbital circulation of meteorites.
- (4) Collision of circulating meteorites with formation of hot centers, surrounded by residual meteoritic swarms which constantly tend to form a more and more congruous system of revolving bodies and to arrive at a final minimum of energy of motion consistent with the initial moment of momentum of the system.

The first feature has already been described. For the evidence of (2) I will refer to Von Reichenbach's researches as condensed by Winchell. Von Reichenbach finds

all meteoric stones to be compounded of parts—hundreds or even thousands of mechanically separate constituents. Ordinary meteoric stones are aggregates of smaller meteoric stones. Both the larger and the smaller are composed of substances whose arrangement always follows a certain order. In the center are oxidized substances, such as silicates; upon these are layers of sulphurets, graphite, and finally of native iron. If either class of constituents is absent, the remaining ones follow the fixed order. Thus there has been a growth; and the oxides or stony constituents are older than the metallic. So, also, the smaller constituent meteorites are older than the conglomerates formed by their aggregation.

The formation and cementation of the parts has not been effected through the agency of a fusing heat. If so, the heavier iron would not have settled around the lighter olivine, nor would graphite sustain its actual relation to magnetic pyrites. The primitive olivine was surrounded by a primitive iron-gas. The primitive condition of all the substances was gaseous—not nebulous [*i. e.*, not a mixture of gas and fine dust. The latter, or true “nebulous” stage, followed later.] Under conditions once existing, the oxygen was active and entered into its combinations, forming the primitive stony nuclei of meteorites. Later,

the sulphides, and then the graphite, were isolated and deposited. Finally, either because the oxygen was exhausted or inactive, or because the work was carried on in a different laboratory, the unoxidized iron was deposited in layers and fillings of all the interstices. All these layers are crystalline.

Thus, before the existence of the meteorites which fall from heaven in our time, there must have been a certain period in which smaller, finer, and more numerous meteorites were produced—"as mere dust, [like] starch-flour, sand, grains to the size of hail-stones"—these in their microscopic structure composed of still minuter bodies.

Shooting-stars and fire-balls are only meteoric bodies, so small as to be dissipated in our atmosphere on their way to the earth. Nickel and cobalt, he explains, are found in all our soils. They are not afforded by the rocks from which soils are chiefly formed; but they are characteristic constituents of meteorites. The constituent parts of meteorites present evidence of collision and attrition. They are rounded, as well as angular and subangular. The very dust worn from them is cemented together with the larger kernels and balls by means of nickeliferous iron. When ignited in our atmosphere, [the smaller ones] are again dissipated in vapor.

The facts noted under (3) simply follow from the action of gravitation on a widely dispersed and irregularly shaped swarm of meteorites; and for the general conclusion of (4) I will quote the very lucid explanation by Dr. Percival Lowell in his book, "The Evolution of Worlds," (pp. 140-143):

Momentum means the quantity of motion in a body. It is the speed into the number of particles or the mass. Moment of momentum denotes the rotary power of it round an axis. Now the curious and interesting thing about this quantity is that it can neither be diminished nor increased. It is an abstraction from which nothing can be abstracted—but results. It is the one unalterable thing in a universe of change. What it was in the beginning in a system, that it forever remains. Because of this unchangeableness we can use it very effectively for purposes of deduction. One of these is in connection with that other great principle of physics, the conservation of energy. By the mutual

action of particles on one another, by contraction, by tidal pulls, and so on, some energy of motion is constantly being changed into heat and thus dissipated away. Energy of motion, therefore, is slowly being lost to the system, and the only stable state for the bodies composing it is when their energy of motion has decreased to the minimum consistent with the initial moment of momentum. This principle we shall find very fecund in its application. It means that our whole system is evolving in a way to lessen its energy of motion while keeping its quantity of motion unchanged. The universe always does a thing with the least possible expenditure of force and gets rid of its superfluous energy by parting with it to space. Philosophers may wrangle over its being the best possible of worlds, but it is incontrovertibly mechanically the laziest.

Now this generalization finds immediate use in explaining certain features of the solar system. In looking over the congruities it will be seen that deviation from the principal plane of the system or departure from a circular orbit is always associated with smallness of size. The insignificant bodies are the erratic ones. Now it has been shown mathematically in several different ways that when small particles collect into a larger mass, the collisions tend to make the resultant orbit of the combination both more circular and more conformant to the general plane than its constituents. But we may see this more forthrightly by means of the general principle enunciated above. For in fact both results are direct outcomes of the conservation of moment of momentum. Given a certain moment of momentum for the system, the total energy of the bodies is least when they all move in one plane. This is evident at once because the components of motion at right angles to the principal plane add nothing to the moment of momentum of the system. It is also least when the bodies all revolve in circles about the center of gravity. The circle has some interesting properties which almost justify the regard paid to it by the ancients as the only perfect figure. It encloses the maximum area for a given periphery, so that according to the old legends, if one were given as much land as he could enclose with a certain bull's hide, he should, after cutting the hide into strips, arrange these along the circumference of a circle. Now this property of the circle is intimately connected with the fact that a body revolving in a circle has the

greatest moment of momentum for the least expenditure of energy. For under the same central force all ellipses of the same longest diameters—major axes these are technically called—are described in the same time, and with the same energy, and of all such, the circle encloses the greatest area, which area measures the moment of momentum.

Given a certain moment of momentum, then the energy is least when the bodies all move in one plane and all travel in circles in that plane. As energy is constantly being dissipated while any alteration among the bodies is going on, to coplanarity and circularity of path all the bodies must tend, if by collision they be aggregated into larger masses. As in the present state of our system the small bodies travel out of the general plane in eccentric ellipses while the big ones travel in it in approximate circles, the facts indicated that the origin of the larger masses was due to development by aggregation out of smaller particles.

The direction of the planetary rotations must also be considered, since there are anomalies which have to be explained. I shall again quote Dr. Lowell (*Ibid.*, p. 145):

Take the case of a retrograde spin of a planet as compared with a direct one. The energy of the planet's spin is the same in both cases, because energy depends on the square of a quantity; to wit, that of the velocity, and is therefore independent of sign. Not so the momentum. For this depends on the first power of the speed, and if positive in the one case, must be negative in the other. The moment of momentum of the whole system, then, is less in the former case, since the moment of momentum of the retrograde rotation must be subtracted from, that of the direct rotation be added to, that of the rest of the system. For a given initial moment of momentum with which the system was endowed at the start, there is, then, superfluous energy in the first state which can be got rid of through reduction to the second. Nature, according to her principles of least exertion, avails herself of the chance of dispensing with it, and a direct rotation results. Sir Robert Ball first suggested this argument. Tidal action accomplishes the end. In checking up a body rotating contrary to the general consensus of spin, its first effect is to start to turn the axis over. For the body is in dynamical unstable

equilibrium with regard to the rest of the system. . . . As the force increases greatly with nearness to the sun, the effect would be most marked on the nearer, and most so on the biggest bodies. This would account for the otherwise strange gradation from retrograde to direct in the tilts of the axes of the outer planets, and also for the present tilts of all the inner ones.

We have arrived at the general conclusion that the sun has originated in a condensation of a small part of some gaseous nebula into a swarm of meteorites. At first the temperature of such a body is but little elevated. According to Lockyer's "Meteoritic Hypothesis," streams of meteorites in orbital motion have interpenetrated and finally, through frequent collisions, have formed a central group, the nucleus of the future sun. Heat generated by multitudinous impacts of meteorites continually mounted, resulting eventually in a fluid sphere. Subsequent meteoritic arrivals added to this body, but the individual meteorites from thenceforth ceased their orbital motion at the fluid boundary. Their kinetic energy of orbital motion became the desultory vibratory motion of heat. The nucleus expanded by accretion, but the meteoritic swarms diminished in radius, being drawn in toward the center by gravitation, thus gradually losing their gravitational potential. Eventually the mounting temperature vaporized the central core. That some such process was Swedenborg's essential conception of the origin of the sun's heat may be seen from the following statement in *Divine Love and Wisdom* (n. 157): "The angelic idea of the fire of the sun of the natural world and of the fire of the sun of the spiritual world, is this: that in the fire of the sun of the spiritual world the Divine Life is from within, but in the fire of the sun of the natural world it is from without."

The existence of extensive streams made up of discrete particles of meteoritic matter, either stony or metallic, is a recent acquisition of science. We have no means of tracing their history backward, but we presume that these streams are a

feeble remnant of the vast swarm which once surrounded the sun.

Swedenborg wrote before this important discovery was made but his description of the origin of the solar system fits very harmoniously into this body of new terms. We may now translate his hypothetical terms and for "fourth finites" may read *atoms* and aggregations of atoms into *meteorites*. A fluid sphere, "active" from internal heat, has formed. Its surface becomes a barrier, or "guard," which "prevents the other [outside] finites [meteorites] from penetrating into the solar space and thus from any longer projecting themselves into it." (*Principia*, Part III, Chap. IV, n. 2.) That is to say, the outer meteorites can no longer continue their free orbital motion into the inner space which has now become fluid and hot.

We thus reach a new stage of solar development and find an intensely active (hot) central space, surrounded by a shell or "crust" of relatively cool and dark matter—the remnant of the meteoritic swarm—the whole constituting a dark sun, not yet ready to shine. But after a time, the accumulating heat, unable to escape freely as luminous radiation, produces intense internal commotion and a delicately balanced unstable equilibrium which finally bursts the barrier. The inner fires then belch forth. The dark sheath is rolled up and cast off, to break up subsequently into planets, shown diagrammatically in Swedenborg's figure as seven in number, one more than was known in his day. Whether he took this mode of hazarding a guess that the planets would be found to be more than six is not important. More noteworthy is his grasping the fact that the phenomenon of new stars (known since the time of Hipparchus) was neither more nor less than the birth of a new world, or worlds. His picture of the rolling off of a dark outer solar envelope gives exactly what is needed to account for this cataclysmic occurrence. He gives a list of the known

novæ of his time and definitely assigns to them this origin. In confirmation of this explanation and in further agreement with the assertion that the new planet (or planets) having been thus violently ejected, will continue to move outward along a spiral orbit until a final position of equilibrium is reached, let it be noted that for many weeks after the outburst of *Nova Persei* in 1901, there were fluctuations in the light of this star such as might be attributed to the tide-raising power of an orb in close proximity to, and in rapid revolution around the central primary, and that these fluctuations showed a lengthening period and diminishing intensity, as they should do if caused by a receding body whose period of orbital revolution progressively lengthens. Nor is this the only nova which has shown such fluctuations, although there is much variety and some irregularity in the procedure, which is a thing to be expected, considering the intensity and complexity, the explosive violence, and the enormous scale of these occurrences.

Swedenborg again likens the ensheathed sun to an elementary particle, this time not without a certain resemblance to a bubble. "The whole of this immense crust," he says,

together with the enclosed solar space, is not unlike an elementary particle; for in each elementary particle there is an active space, exteriorly to which flow the finites. Thus, both as to figure and motion, this chaos is, on an immense scale, an effigy of each individual part of an elementary particle. (*Ibid.*, n. 4.)

This incrusting matter, being endowed with a continual circular motion round the sun, in the course of time removed itself farther and farther from the active space; and in so removing itself, occupied a larger space, and consequently became gradually attenuated, till it could no longer cohere throughout, but burst in some part or other. That this crust, covering the sun and rotating with it, was removed gradually to a greater distance from it, is evident from this fact; that the space within was continually active [hot], and incessantly acted upon the walls and barriers of its prison [proressively vaporiz-

ing them]; that the incrusting expanse or volume which was perpetually revolving, tended, by its centrifugal force, to a farther distance. (*Ibid.*, n. 5.)

The solar crust, being somewhere broken up on the admission of the vortical volume, collapsed upon itself; and this toward the zodiacal circle of the vortex, or conformably to the arrangement and motion of the elementary particles; so that it surrounded the sun like a belt or broad circle. This belt, which was formed by the collapse of the incrusting expanse, revolved in a similar manner; removed itself to a greater distance; and by its removal became attenuated till it burst, and formed into larger and smaller globes; that is to say, formed planets and satellites of various dimensions, but of a spherical form. (*Ibid.*, n. 6.)

If it were permissible to substitute in place of a fluent medium carrying the planets round the sun in its stream, the conception of a vortical whirl of meteoric particles, we might annex the primal vortex of Des Cartes and Swedenborg to modern theory, but this would be stretching the interpretation too far. Swedenborg, however, likens his dark sun to the chaos and Erebus of the ancient philosophers whose guesses are now, to a certain extent, confirmed by scientific observation. He says:

Now if the entire chaos existed in this manner, it follows that for a considerable period the sun would be shut out of its vortex, and lie with its beams imprisoned within a crust, without any elementary expanse into which it could diffuse itself. Ovid accordingly says that its "face was in pitchy darkness veiled";* and in another place, that "Such double night of storm and pitchy cloud obscures the guiding skies";† also, when he sings of chaos, that "No Titan gladdened yet with light the world,"‡ and "The air was void of light";§ and again, in the sequel, that now, "The weightless force of convex Heaven shot upward."||

* *Metamorphoses*, lib. I, l. 265, translated by H. King.

† *Ibid.*, lib. XI, ll. 549, 550.

‡ *Ibid.*, lib. I, l. 10.

§ *Ibid.*, lib. I, l. 17.

|| *Ibid.*, lib. I, l. 26.

In this way did the ancient philosophers conceive that Night and Tartarus were in a chaotic state; and that from Night sprang the Earth, the Ocean, and the Heavens. Moses also makes mention of darkness, and of an abyss. But Aristophanes and others come still nearer to our philosophy:

“The black-winged Night first lays a windy egg,
Whence in the circling hours sprang wished-for LOVE,
The golden feathers glitt’ring on his back,
Resembling the tempestuous vortices.”¶

This is the same as if he had thought that the sun was enclosed in an egg, from which, endued with revolving motion, it afterwards went forth.

This philosophy is not without evidence derived from actual observation, for celestial phenomena appear to confirm it. Stars have been known to come into view, and after a lapse of time, to grow obscure and become invisible; then again to become visible, and again obscure; so that either they disappear altogether, or else, unless some neighboring stars [dark obscuring stars?] should in the meantime occupy their vortex, remain permanently in sight. Here then we see the origin of the planets actually imaged forth to the eye. We see, as it were, the same incrustations arising from the compression of the circumfluent elementary parts, and veiling over the star or sun to which they belong; we see also their repeated dissipations and separations. Astronomy is full of evidence of phenomena of this kind, and continues to this very day to offer to the eye those representations of chaotic condition of which we have been speaking. (*Ibid.*, n. 7.)

A nova sometimes passes into a planetary nebula, that is, into a circular disk of appreciable angular radius even when viewed from our enormous distance, and one which possesses a gaseous spectrum. Here, at least, a portion of the star has been dissipated into a great sphere of heated gas and dust, thus restoring the nebulous, or meteoritic condition from which the star is supposed to have originated. Such a reversal of the

¶ *Comœdiæ*, “Aves.” ll. 695-697, translated by C. A. Wheelwright.

process of condensation, even though it may be only a temporary episode, cannot be attributed to a recrudescence of centrifugal force, but is rather to be viewed as the result of a gigantic explosion arising from the elimination of an excess of unstable substances by disintegration and destruction of their atoms. This suggests that the process is the normal one for the formation of a planet, failing only in this case from excess of power. Or possibly the main purpose of the action—the production of a separate new attendant orb—may have been accomplished, after all, in the midst of this welter of conflicting forces.

The velocities produced are very great. An explosion of such gigantic magnitude cannot be absolutely instantaneous and several hours are occupied in developing the full effect of the cataclysm. Initial velocities of the order of 1,000 kilometers per second are recorded for great masses of gas. "Thus *Nova Aurigæ* exhibited a velocity of 800 kilometers per second in February, 1892. After the revival of luminosity in August, 1892, a velocity of —255 kilometers per second was measured, and in August, 1893, this had diminished to —71 kilometers per second. The gaseous streams must have reached three times the distance of Neptune in a year and a half," if the motion were of the same mass of matter and continued at this rate.

"All of the novas show the same general sequence of phenomena. The sudden release of superheated interior substances from the depths of the star gives a continuous spectrum of extraordinary brilliancy, rich in the shorter waves, which rapidly passes into a spectrum of the Orion type with narrow dark lines of hydrogen and helium. This is followed by an enormous evolution of hot gases. The complex banded structure of the broad bright Fline indicates radiation from a number of streams of hydrogen moving with different velocities. The great breadth of the lines may mean that the gas is under

great pressure, or in a condition such as might be expected if intensely heated matter from the depths of a star has been opened to view by disruption" but is also partly due to a wide range of velocities in the line of sight.*

"This view of the case has been partly anticipated by Professor W. H. Pickering, although he has not predicated so profound a disturbance as the actual disruption and dissipation of a star. Assuming that the phenomenon is produced by gaseous eruptions, he says: 'Prominences upon an enormous scale burst forth, spreading in every direction, and completely enveloping the star upon all sides. When they first appear, they present a spectrum of bright lines, but in a few hours the gases first emitted have receded to a considerable distance from the star, and have cooled down owing to the rapid expansion involved in their recession. . . . This cold advancing atmosphere produces a series of dark absorption lines. . . . The hot receding prominences, however, . . . give out a light whose wave-length cannot be absorbed by the cold advancing atmosphere. They, therefore, shine with their full brilliancy.'"

"It is notable that every nova which has been examined spectroscopically at the proper stage, has exhibited this sequence:

"1. An intensely bright continuous spectrum rich in violet light.

"2. Paired dark and bright lines of hydrogen, etc., the dark lines on the violet side indicating approach, the bright on the red side showing recession. The lines are very broad, denoting

* In the *Astrophysical Journal* for March, 1920, p. 126, Walter S. Adams and Cora G. Burwell, comparing the displacement of the absorption bands with the widths of the bright bands in four novae, find that "in each case the width is very nearly twice that of the corresponding displacement" and conclude that "the cause which produces the displacements of the dark lines must be mainly responsible for the widening of the bright bands. This would favor the view that the Doppler effect is the principal agent involved."

either great pressure or a wide range of velocity in the line of sight.

"3. Fading of the continuous spectrum, produced by cooling of photospheric clouds until these are entirely dissipated, leaving:

"4. A purely gaseous spectrum. Pressure and differential velocity diminishing until nothing is left but a planetary nebula whose light may be due to collisions of meteorites, crystallized out of the expanded and cold gases, perhaps aided by some kind of electric or cathode discharge along filaments or sheets made up of discrete particles. (F. W. Very. "A Cosmic Cycle." *American Journal of Science*, (4), Vol. XIII, pp. 111-112.)

Rev. Walter Sidgreaves of the Stonyhurst College Observatory called attention to a periodic variation in the hydrogen bands of *Nova Persei*. These were symmetrical at a time of minimum light, but unsymmetrical at the epochs of greatest luminosity. In *Astronomische Nachrichten*, Nr. 3771, I analyzed these varying bands and showed that the symmetrical ones were due to a single expanding shell of gas; but when tidal forces, presumably due to the attraction of the newly-born revolving planet, caused the eruption of a new and hotter shell, attended by a flare-up in the general luminosity, the band became complex and represented the combined radiation and absorption of both shells. The phenomenon, therefore, represented a series of rhythmical explosions with intervals of rest.

The total breadth of the violet ($H\delta$) band of hydrogen, according to Mr. Walter S. Adams, extended from $\lambda 4067$ to $\lambda 4146$ with the center at 4105 Angström units. On March 18, 1901, Campbell and Aitken at the Lick Observatory recorded three dark absorption lines on the violet side of all of the hydrogen bands in the region of the unsymmetrical absorption on the violet edge. Their displacements at $H\delta$ were:

(1) Faintest, -27.3 ; (2) Stronger, -24.5 ; (3) Strongest,* -20.6 Angström units (or ten-thousandths of a micron). These correspond to velocities in the line of sight of 1996 km. = 1240 miles per sec., 1791 km. = 1112 miles per sec., and 1506 km. = 935 miles per sec. Admitting that the respective sheaths of gas were thrown off at intervals of about a day, according to the light-fluctuation at the time, they represent spherical envelopes at distances of 107×10^6 , 203×10^6 , and 284×10^6 miles. Now the diminution of the solar parabolic velocity between these extreme limits of distance is about nine miles, whereas the nova gives 305 miles for the same interval; whence it follows that the mass of *Nova Persei*, 1901, must be about $(33.9)^2 = 1149$ times the mass of the sun.

With such a mass, it is easy to believe that phenomena of uncommon magnificence, bearing witness to a display of enormous energy, have resulted from disturbances on so grand a scale. It seems probable that the preparation for a nova is of very long duration, and that long before its appearance, the nova has been a single body of great mass and considerable central condensation; also that it has previously been intensely hot at the center, but surrounded by clouds of discrete meteorites, which had not yet coalesced with the primary in its antecedent condensation, and which have prevented its appearing as a luminous body, until at last the pent-up internal forces have burst their bounds and have dissolved the last remnants of obstructing matter in a final blaze.

In this instance there does not seem to have been any large loss of substance by the explosive eruptions of gas. The nucleus still retains its great mass, and the variation of luminosity in a more than centesimal ratio is evidence that no conclusion can be drawn from the brightness of a star as to its actual mass or size. The fading of the continuous spectrum is perhaps due to a

* The strongest line corresponds to the absorption of the coolest hydrogen, or to the layer of gas which has been transported to the greatest distance and whose velocity has diminished most under the retarding influence of the central gravitational attraction.

reprecipitation of clouds of cosmic dust after the first outpouring of intense radiation and highly heated gases has dispersed the superfluous energy.* If so, we may anticipate a gradual recuperation of forces, and a possible renewal of luminosity at some remote epoch, although perhaps never again after the manner of the original appearance of the nova. (*Astr. Nachr.*, Nr. 3771, p. 40.)

The explanation which I have given of the origin of a nova differs from some that have been favored by astronomers, but I think that good reasons can be found against the other views. Thus Lockyer and others have predicated collisions between meteorites in vast interpenetrating meteor-swarms as the cause of the phenomenon. If so, the swarms might become associated, and recurrences of such outbursts should happen with increasing frequency. Nothing is known that supports such association. But there are more vital objections to the explanation.

If produced by the meeting of meteor-swarms, the nova ought to begin as it ends. The first collisions of sparsely distributed outlying members of the swarm should give a spectrum of bright lines; these should increase in brilliancy, the continuous spectrum and greatest intensity occurring near mid passage, while the densest parts of the swarms are in collision. The sequence is entirely different and points to a sudden liberation of imprisoned forces, and to control from a fixed center, the relative velocities being none at all at first, but increasing to extraordinary proportions at the height of the episode. There may have been a meteor-swarm anterior to the nova, but, if so, it had already condensed, and it was a single body. ("A Cosmic Cycle," p. 114.)

Another suggestion is that a dark wandering star has

* Van Maanen finds that the absolute brightness of the central star in a planetary nebula, an object which sometimes succeeds to a nova, averages 4 to 5 magnitudes fainter than our sun, as if the star might be shining through a haze of meteoritic particles which have resulted from the central explosion and which form the encompassing nebulous sphere.

passed near the nova and has generated a profound tidal disturbance which has disrupted one or both of the stars. Objections to this are that the Milky Way, in which the new stars are situated, must be very much nearer and its stars much closer together than is commonly supposed, in order that stars shall have a chance to meet with sufficient frequency. And further, that if the disturbance is powerful enough to raise a dark sun to vivid incandescence, the luminosity should last for ages. The rapid cooling to virtual invisibility is appropriate for a swarm of meteorites where the individuals are of relatively small mass.

The nebulosity (briefly mentioned in Chap. IV) which appeared around *Nova Persei*, 1901, and which endured for upwards of a year, is of very great interest to cosmical theory, and it confirms Swedenborg's theory that the interstellar aura is a magnetic medium. We know that the earth is accompanied by a magnetic field which is sensible to some thousands of kilometers, because electrons coming from the sun are drawn into the sphere of the earth's magnetic attraction and arrange themselves by preference along two annular belts encompassing the magnetic poles of the earth and along streams which are parallel to the direction of the dipping needle. Some have supposed that these streams may be composed of alpha particles (helium atoms) expelled from the sun; but their spectrum is not that of helium and the expansion of the auroral zone upon the earth's surface, when the aurora is very strong, is explained by the greater electric charge of the cathode streams at such times and their spreading by mutual repulsion, while under the partial control of the earth's magnetic field. The twist of the spiral paths of the particles which produce the evening aurora shows that these are electro negative. Helium would be positive. We have also seen that the sun is surrounded by a similar magnetic field traceable to a distance of some hundreds

of thousands of kilometers. But these distances are insignificant compared with the immense distances between the stars and do not positively assure us that magnetism can extend so far. In fact, Swedenborg's theory that the entire body of aura is magnetic was a surmise and its universal extent was assumed on other grounds. He says:

That it is the most universal [element or atmosphere] may be concluded *a priori*; because it is the origin of all the subsequent elements; because also it consists of the smallest constituent parts, can occupy the smallest spaces, and be present where no other element can; therefore it may without doubt be concluded, that it is also the most universal. We may come to the same conclusion also *a posteriori*; for in the starry heavens we see with the eyes all the stars, as it were, present to us, yet this presence cannot be effected without contiguity. Consequently from reason instructed by the senses we learn that there is nothing more universal than this element. (*Principia*, Part I, Chap. VI, n. 50.)

It might be supposed from this, that the first element was thought to be the same as the luminiferous ether; but subsequent parts of the *Principia* show us that this is not so. The ether particles which convey light are formed out of the aura by motion and therefore light cannot be propagated where the aura is not. In this remote sense the aura may be said to be contributory to the luminous movement and it gives the substantial basis for the magnetic fluctuations which everywhere accompany the etherion; but the ether must not be confounded with the aura on this account.

The nebulosity of *Nova Persei* was entirely different from the planetary nebula which so often succeeds the appearance of a new star, but was an absolutely unique occurrence as a heavenly spectacle. It consisted of much fine detail arranged in two oval rings and an arc of a third, the whole so faintly luminous that it was invisible in the most powerful telescopes, but left an impression on a sensitive photographic plate after

long exposure. The illumination expanded with extraordinary rapidity, finally reaching a limit, and at length faded away. Some have attributed the phenomenon to reflection of light emitted by the star at its maximum brightness and received upon nebulous material previously existing in the surrounding space. If so, since the rings were not circular, but elliptical, it would be necessary to suppose that the reflecting matter was situated in a plane passing through the star and at an inclination of some 50° to the line of sight. As there was only one outburst of light, no reason can be suggested on this hypothesis why there should be more than one ring. Moreover, since the velocity of light is uniform, the expansion of an illuminated annulus in the supposed plane should be uniform also, which it was not. Besides this, photographs of different dates showed objects of identical shape which had simply been transferred bodily with a little expansion to somewhat greater radial distances from the center. Considering the bizarre shapes of some of these forms, it is inconceivable that numbers of them should be repeated again and again, to be reached in succession and illuminated by an outgoing spherical shell of light. The objects themselves were traveling, and not just the illumination.

Lowell thought that the emanation was simply "gaseous molecules driven off by light pressure alone—the smoke, as one may say, of the catastrophe"—akin exactly to the constituents of comet's tails. . . . The speed was certainly much less than that of light, though greatly exceeding any possible from the direct disruption. But in this case the distance of the star would have to be "much less" than its parallax indicates. Newcomb, in fact, founding his argument on the supposition that the nova was a Galactic object and having what, I think, must now be admitted to have been an exaggerated conception of the distance of the Galaxy, ventured the claim that here we had evidence of a velocity *greater* than that of light. But to

this claim physical theory interposed the objection that matter can not move faster than light, because Kaufmann's experiment shows that its mass would become infinite on barely touching that velocity. Finally, direct measurements of the parallax of the nova have shown that it is not as great as Newcomb supposed and, in fact, that the distance of the star is not incompatible with the supposition that the most rapid motion observed in the luminosity approached, but did not exceed that of light. Had pressure of light been the cause of the emanation, its shape should have been that of a spherical shell and its projection a circle. The motion also should have been accelerated more and more, whereas it was eventually retarded.

Further intricacies were found in the details of this unprecedented occurrence which require a wholly different explanation. I will quote from my paper, "An Inquiry into the Cause of the Nebulosity around *Nova Persei*" (*American Journal of Science*, Ser. 4, Vol. XVI, p. 53 *et seq.*, July, 1903):

The supposition that the observed motions are actually those of some form of matter, either itself luminous, or producing luminosity in widely distributed material with which the moving substances react, demands so large an expenditure of force in sustaining the prolonged movement to enormous distances, that some hesitation in adopting it is pardonable. Yet, considering the stupendous scale of operations in the nova, the objections on this score do not seem insuperable. . . . Professor C. D. Perrine, however, has urged what appear to him to be further objections to the hypothesis of a real translation of matter. He says: "The motions observed are not radial. Nearly all of them have large tangential components. It is difficult to account for these tangential components. A consideration of the condition probably existing in the nebula, upon the assumption of an actual translation of matter, would lead us to expect a very rapid loss of light. The inner ring has decreased in brightness, and some of its features have become too faint to record themselves on the photographs. Several masses, all in the outer ring, have been recorded only on the later photographs, and have grown both in

brightness and size, a condition difficult to explain on the above hypothesis. It is perhaps not inconceivable that the two rings represent different phenomena." If these difficulties urged by Professor Perrine can be removed, nay more, if the facts considered to be objections to a theory of real motion can be shown to be demanded by a special form of the theory, they constitute a strong argument in favor of this explanation.

The difficulties urged by Perrine in regard to the sudden appearance and brightening of local spots on the outer ring, and the tangential motion which prevails in many features, appear to him contrary to what should be expected if the phenomenon is due to actual motion. Evidently the only actual motion considered is a radial one. These difficulties which form the most serious objection to such theories of actual motion as have been hitherto published, become, on the contrary, a strong argument in favor of a different theory of real movement.

The theory which I would propose is that of the actual movement of diamagnetic ions under the control of magneto-electric impulses emanating from the star and following the lines of magnetic force. We may compare such a stream of moving ions to the beam of light from a parabolic mirror. The rays are directed and do not at once expand to fill the entire sphere. Diamagnetic ions may be expected to follow lines of magnetic force to regions of least potential in the magnetic equatorial plane, and with only slight expansion of the tubes of force through a limited range of the magnetic sphere. Hence the luminosity, as in the distinct phenomenon of a comet's tail, may extend to a great distance before becoming too faint for observation, although of course the light must eventually fade, unless perpetually renewed. This seems to answer the objection on account of the long continuance of the phenomenon.

In the next place, if the structure observed in the nebula is to be compared with that of a magnetic phantom, a strong tangential component must enter into lines emanating from the nova after these have extended to a certain distance. The magnetic phantom, whether exhibited by iron filings or by dust of bismuth, extends in sweeping curves from pole to pole of the magnet—the only difference being that magnetic particles move towards the poles, and diamagnetic away from them, but that both follow the lines of force. The observed trajectories of

nebulous material around the nova are in fair, perhaps I should say in nearly perfect agreement with the projection of a system of lines of magnetic force.

If the brightening or sudden appearance of new bright spots on the outer ring can also be explained on this hypothesis, I think it must be admitted that the facts decidedly favor, if they do not demonstrate, the proposed explanation.

Two cases may be distinguished: (a) The light is produced by phosphorescence of dark matter, previously existing in the surrounding space, and made luminous by colliding ions. (b) The moving ions are themselves luminous.

On either hypothesis, the luminous shape is a species of magnetic phantom where only those portions of the general magnetic figure are visible which happen to be infilled with matter capable of becoming luminous under the given conditions.

Two distinct processes can be inferred from the succession of phenomena exhibited by *Nova Persei*. First, there were violent eruptions of hydrogen, helium, etc., with velocities up to 2000 km. per sec., and the formation of concentric shells of glowing gas, reaching distances comparable with those of the planetary orbits; and, second, there was a profound electrical disturbance accompanying this turmoil of the elements, producing a complex and excessively attenuated appendage, thrown off with velocities possibly 150 times as great as those of the gaseous eruptions, and reaching far out into stellar space. It is this second appendage with which we are now concerned. Consider a magnetic line of force lying in a plane including the line of sight from the star to the earth. Particles from the center from the south pole will at first be moving almost end-on and the line of sight will encounter many such particles. The central prominence is therefore brilliant and changes its position slowly. But other particles have moved along the curve to a part of their trajectory where they begin to recede from us with increasing velocity. If the actual velocity is that of light, the component of motion in the line of sight will soon reach a high value—let us say 100,000 km. per sec.—when, even if the original ionic radiation were rich in violet and ultra-violet light, the waves of ether must be so lengthened by the motion of recession that they no longer impress the photographic plate. Consequently, at this radial distance from the star, and in like manner on the opposite

side, the nebula fades out; but at nearly the same radial distance, particles which have passed undetected on account of their recession along lines from the star's north pole, reach positions where the motion of recession changes to one of approach. Violet light begins to emanate from these regions. Soon the motion of approach becomes so vigorous that even red or infrared rays, if they exist, will have their wave-lengths so shortened that they can be photographed. On the supposition that the nebula is a gigantic corona with symmetrical sheaves of filaments around both poles, diverging under angles of something over 60° —one capable of being photographed, the other not—the puzzling phenomena of appearance and disappearance at the outer ring are explained. They are demanded by the theory, instead of being anomalies.

The repetition of the phantom in forms which, at least in the early days, were moving with velocities in the ratio of $1 : 2 : 4$, conjoined with Sir J. J. Thomson's observation that "canal," or positive, rays in a vacuum-tube consist of particles having just this ratio of masses and velocities, completes the demonstration that here was an emanation of positive rays on a gigantic scale, but guided by a magnetic field as far reaching as the distances between the stars, confirming Swedenborg's conception that an atmosphere as extensive as the interstellar one is concerned in magnetism.

We have seen that Swedenborg teaches that what was originally a dark and, at least externally, a cold sun, has become hot and glowing. He also speaks of compression. We may believe that at any rate a part of the solar heat has been produced by condensation, and Lane's Law asserts that a sun which is a gaseous body "contracts, and the heat generated by the contraction exceeds that which it had to lose in order to produce the contraction." This, to Professor Winchell, seemed so unreasonable that he challenged it in his book, "World-Life, or Comparative Geology" (p. 83 *et seq.*). The point is important and the challenge should be met.

Professor Simon Newcomb, in his "Popular Astronomy," had said in respect to the continual generation of the sun's heat: "As his globe cools off it must contract, and the heat generated by this contraction will suffice to make up almost the entire loss." On which Professor Winchell comments: "That is, cooling causes contraction, and contraction causes heat; therefore *cooling causes heat*." The criticism applies not to Lane's Law, but to Newcomb's manner of stating it which should have read: "As his globe loses its potential energy of position, the mean temperature of the mass will increase." Winchell says: "The condensation, supposing always that the aggregative process is completed, can only respond to loss of heat. No condensation can take place except as a consequence of such loss. The condensation, therefore, *cannot increase the heat*." This misrepresents the case. Aggregation is not "completed" until the solid state is reached. Lane's Law only applies to a gaseous body. A portion of gas, cooled by radiation at its surface, may, we will suppose, condense to solid or liquid particles whose fall generates kinetic energy to be finally overcome by friction. The frictional heat is more than sufficient to revaporize the particles. It has also imparted energy to the impeding masses of gas; but the particles have lost potential energy by the fall. The place of the first fallen particles is taken by others elevated in their stead and at their expense. If the second particles had to be lifted as high as the first were when in their initial position, energy would be expended and the outer radiating surface would be cooler than before. But if this radiating surface is itself sinking, the raised particles require less energy to lift them a shorter distance and may be hotter than the initial ones at the end of their journey when ready for a new cycle of changes. If the radiating surface is hotter than before, its density is less and a layer of constant density has been displaced inwards, while the density and also

the temperature of layers below a certain depth have increased, and heterogeneity has increased.

Newcomb's summary of the law ought to be sufficient to clear up the matter in dispute. He says: "If a globular gaseous mass is condensed to one-half its primitive diameter, the central attraction upon any part of its mass will be increased four-fold, while the surface upon which this attraction is exercised will be reduced to one-fourth. Hence the pressure per unit of surface will be increased sixteen times. Hence if the elastic and gravitating forces were in equilibrium in the primitive condition of the gaseous mass, its temperature must be doubled in order that they may still be in equilibrium when the diameter is reduced one-half."

But Winchell, though he quotes this statement, is not convinced. He argues at times as if the only heat to be considered is that of the original thermal state, and overlooks that there is a constant production of *new* heat by conversion of the potential energy of position as just noted. He says: "If only the excess developed is lost, the body remains of the same temperature as at first, and, therefore, is not cooling." This states the case imperfectly. The *photosphere* may, and probably does, remain at a sensibly constant temperature, maintained by some physical process which acts as a regulator. The effective surface temperature, however, may vary through changes in the depth or composition of an absorbent atmosphere above the photosphere.

The stage antecedent to a nova is a mixed one. There may be a liquid or even a gaseous kernel, but it is encompassed by extensive layers composed of discrete solid particles. Lane's Law does not apply until a truly gaseous stage is reached throughout the mass. Afterwards there may be an inner core which is growing hotter, an outer layer which is cooling, and between them a photospheric layer which is isothermal. The outer cooling layer is replenished with heat from time to time

by eruptions of hot gases from the interior; but owing to the great viscosity of the deeper layers, the interchange of heat is hampered and the deep layers may still retain an excess of temperature far above what a perfectly free convectional equilibrium would give. We have an analogous case in the Earth's atmosphere with the difference that the sun's rays which are the source of heat for our isothermal layer, are above instead of beneath.

The objections named by Winchell do not in any way affect the theory of the development of heat by the condensation of a swarm of separate and cold meteorites, drawn together by the attraction of gravity, until they coalesce into a continuous gaseous mass; nor do they overthrow the doctrine that for a time the development of heat in the inner layers of the gas by further shrinkage may surpass the losses because the *rates* are different. Eventually, the balance will lie on the other side; and as a geologist, Winchell might easily have contended from the geologic proof of a long terrestrial duration that the epoch of a reversal of the balance must have passed long ago if the accession of heat by contraction were the only source of supply. He does not avail himself of this argument, unless it be in the very dubious remark that "The equilibrium must be completed by some reactionary force which would exist at absolute zero of temperature." As he does not explain this remark, it is impossible to say what he may have meant. The evidence now available points to the energy set free by the disintegration of the atoms as sufficient for all the needs of solar sustenance. One of its consequences is a diminution of the sun's mass and a continual removal of the planets to greater and greater distances. This evidence, added to that from the study of the theory of tidal influence on planetary recession which Sir George Darwin has expounded with masterly skill, confirms Swedenborg's theory of a planetary recession from the sun.

CHAPTER XI

SWEDENBORG'S THEORY OF THE STARRY HEAVENS

FOUNDING his thoughts upon a resemblance between greatest and least things in nature, and considering that the magnetic sphere about a magnet is composed of minute vortices of a ferruginous emanation, each an elementary magnet, all joined together by their poles, and flowing in curvilinear streams to form a composite vortex, whose magnetic strength is the sum of the magnetic flow of the myriads of least vortices in the sphere, Swedenborg conceived that the great Galaxy of stars that we see may have a similar arrangement and that the myriads of stars correspond to the aforesaid least vortices of the magnet, that they are consociated and guided in a vast magnetic sweep which has its galactic poles like those of the magnet. His description is somewhat marred by being mixed up with a vortical scheme suggested by the Cartesian one, though not identical with it, but we need not pay attention to that. Enough can be rescued to transform the general conception, appropriately filled in with details supplied by observation, into a valuable addition to our knowledge. He says:

The whole visible starry heaven is one large sphere, and its suns or stars, together with their vortices, are parts of a sphere connected one with another in the way we have mentioned.

The axes of the vortices in this sphere are variously bent or curved, and all the elementary particles in this sphere have the same arrangement as the vortices themselves, or the sphere itself; hence the vortices, as well as all the elementary particles in the axes themselves, are spheres having a rectilinear disposition; but those extending from the axes have a curvilinear arrangement, or one which is bent relatively to the axes. We have

before shown that the elementary particles have the same arrangement as the vortices, or that the arrangement of these particles is according to the figure of the sphere. For if there is a vortical motion among the elementary particles, and if one vortex is conjoined with another by means of its motion, then it is conjoined as to its sphere.

The common [circular] axis of the sphere or starry heaven seems to be the Galaxy, where we perceive the greatest number of stars. Along the Galaxy all the vortices are in a [sensibly] rectilinear arrangement and series, and cohere as to their poles; in like manner, they are then more intimately associated, and have spires of greater curvature. The other solar or stellar vortices afterwards proceed from the axis, and are bent in different directions; but nevertheless all have reference to that axis. This is a consequence of the preceding observations. For the greater the number of active centers in the same space, the closer and more interior is the association of the spirals. Their greatest number is in the Milky Way, and there also their reciprocal conjunction is the strongest.

There may be innumerable spheres of this kind or starry heavens in the finite universe. These may be associated one with the other, like the spheres of two magnets; and the whole visible starry heaven is perhaps but a point in respect to the universe. The objects comprehended within the range of our bodily vision are perhaps few; the greater number can be comprehended only by the mind. This very starry heaven, stupendous as it is, forms perhaps, but a single sphere, of which our solar vortex constitutes only a part; for this universe is finited in the infinite. Possibly there may be other spheres without number, and other heavens without number similar to those we behold; so many, indeed and so mighty, perhaps, that our own may be respectively only a point; for all the heavens, however many, however vast, yet being but finite, and consequently having their bounds, do not amount even to a point in comparison with the infinite. (Portions selected from *Principia*, Part III, Chapter 1, numbers 6, 8, and 11.)

This is the first statement of what is known today as "*The Island Universe Hypothesis*," for a long time viewed with disfavor by most astronomers, but now practically demonstrated.

The conception has been given an imaginative setting in the rhapsody (or *bravura*, as De Quincey calls it) of Jean Paul Richter:

To the right hand and to the left towered mighty constellations, that by self-repetitions and answers from afar, that by counter-positions, built up triumphal gates, whose architraves, whose archways—horizontal, upright—rested, rose—at altitudes, by spans—that seemed ghostly from infinitude. Without measure were the architraves, past number were the archways, beyond memory were the gates. Within were stairs that scaled the eternities above, that descended to the eternities below; above was below, below was above, to the man stripped of gravitating body; depth was swallowed up in depth unfathomable. Suddenly, as thus they rode from infinite to infinite, suddenly as thus they tilted over abysmal worlds, a mighty cry arose—that systems more mysterious, that worlds more billowy,—other heights and other depths,—were coming, were nearing, were at hand. Then the man sighed and stopped, shuddered and wept. His overladen heart uttered itself in tears; and he said,—“Angel, I will go no farther. For the spirit of man aches with this infinity. Insufferable is the glory of God. Let me lie down in the grave from the persecutions of the infinite: for end, I see, there is none.” And from all the listening stars that shone around issued a choral voice, “The man speaks truly; end there is none, that ever yet we heard of.”*

But this is not science. In the calm light of science, the immensities of space have no terrors; and as Swedenborg saw, mere greatness of material size is of no account. It is the greatness of truth that is to be adored. The infinitude of Divine Creative Wisdom is as much exhibited in a tiny atom as in a stellar system. God never persecutes. Ignorance may unwisely oppose the truth, but truth is the only thing that can save it.

Halley, who was Swedenborg’s teacher in astronomy, knew

* Done into English by Thomas De Quincey, with slight alterations.

of only two nebulæ, those in Orion and Andromeda. But during the next century Messier and Lacaille had increased their number to between one and two hundred, and when Sir William Herschel surveyed the heavens with his giant telescope, their number was increased to several thousand. With the still larger telescopes which we now have, and by the help of photography which enables us to accumulate the action of a faint light by long exposures, probably upwards of a million of these objects are within range of possible observation. The elder Herschel believed that the irresolvable nebulæ would be separated into stars by a still more powerful telescope than his. From the association and gradation of hazy nebulous material into stellar, he believed that the stars were derived from nebulæ, being condensed by the attraction of gravity.*

The association of stars with nebulosity can be equally well accounted for, if we suppose a gaseous emanation from the stars, and there is reason to believe that sometimes the one process, sometimes the other occurs. Miss Clerke says: "The trapezium-stars in Orion, like crystals embedded in their rocky matrix, are still thickly folded in the generating cosmical stuff. By Dr. Huggins's photograph, they may be said to be 'caught in the act' of completing their transformation, a partial survival of the original community of gaseous nature being made apparent through their self-recorded bright lines." But the nebulosity around Nova Persei was even more surely "caught in the act" of emanating and moving *away from* the star.

While the Nineteenth Century added greatly to the number of known nebulæ, it did but little to clear up the problem of their nature. Professor Cleveland Abbe went on record in the Monthly Notices of the Royal Astronomical Society in 1867, as being of the opinion that the true nebulæ are galaxies,

* Phil. Trans., Vol. CI, p. 330.

or complex aggregations like our own Milky Way, and are "composed of stars (either simple, multiple, or in clusters) and of gaseous bodies of both regular and irregular outline." But the overwhelming majority of astronomers rejected Swedenborg's theory.

Miss Clerke wrote in 1890:

The question whether nebulae are external galaxies hardly any longer needs discussion. It has been answered by the progress of discovery. No competent thinker with the whole of the available evidence before him, can now, it is safe to say, maintain any single nebula to be a star system of co-ordinate rank with the Milky Way. A practical certainty has been attained that the entire contents, stellar and nebular, of the sphere belong to one mighty aggregation, and stand in ordered, mutual relations within the limits of one all-embracing scheme—all-embracing, that is to say, so far as our capacities of knowledge extend. With the infinite possibilities beyond, science has no concern.*

Three arguments are given which she considers to be proofs of her conclusion.

1. It has been calculated that if the Andromeda nebula were a universe apart of the same real extent as the Galaxy, it should be situated, in order to reduce it to its present apparent dimensions, at a minimum distance of twenty-five Galactic diameters. And a Galactic diameter being estimated by the same authority [Richard A. Proctor?] at thirteen thousand light years, it follows that on the supposition in question, light would require 325,000 years to reach us from the nebula. The star then which suddenly shone out in the midst of it in August 1885, should have been at 564 times the distance inferrible from its effective brightness. In real light it should have been equivalent to 318,000 stars like Regulus, or to nearly *fifty million* such suns as our own! But even this extravagant result inadequately represents the real improbability of the hypothesis it depends upon; since the Andromeda nebula, if an external galaxy, would almost certainly be at far greater remoteness from a sister-galaxy than would

* "The System of the Stars," by Agnes M. Clerke. 1st Edition, p. 368.

be represented by twenty-five of its own diameters. (*Ibid.* pp. 369-370.)

Miss Clerke's second argument is this:

Just as the Milky Way might be described as a great compound cluster made up of innumerable subordinate clusters, so the greater Magellanic Cloud seems to be a gigantic nebula embracing and bringing into some kind of correlation, multitudes of separate nebulae. To the naked eye it shows vaguely a brighter axis spreading at the extremities so as to produce a resemblance to the "Dumb-bell" nebula; it shows, that is to say, signs of definite organization as a united whole; and it includes, strangely enough, among its inmates a miniature of itself (N.G.C., 1978), but of much greater intensity and distinctness. Sir John Herschel's enumeration in 1847 of the contents of the "Cloud" gave conclusive evidence of the interstellar situation of nebulae—evidence the full import of which Dr. Whewell was the first to perceive. Over an area of forty-two square degrees, 278 nebular objects (stars being copiously interspersed) are distributed with the elsewhere unparalleled density of $6\frac{1}{2}$ to the square degree. "The Nubecula Major," Herschel wrote, "like the Minor, consists partly of large tracts and ill-defined patches of irresolvable nebula and of nebulosity in every stage of resolution, up to perfectly resolved stars like the Milky Way, as also of regular and irregular nebulae properly so called, of globular clusters in every stage of resolvability, and of clustering groups sufficiently insulated and condensed to come under the designation of clusters of stars." Here then we find—in a system certainly, as Herschel said, "*sui generis*," yet none the less, on that account, instructive as to cosmical relationships—undoubted stars and undoubted nebulae at the same general distance from the earth. Some of the nebulae may indeed very well be placed actually nearer to us than some of the stars; and the extreme possible difference of their remoteness cannot in any case exceed one tenth of the interval between the hither edge of the Cloud and ourselves. We learn too the plain lesson that distance is only one factor in the production of "irresolvability." For stars in every stage of crowding, from loose groups to the veriest dust-streaks, globular clusters coarse and fine, nebulae of all kinds and species, range side by side in this extraordinary collection,

proving beyond question that differences of aggregation are real and enormous and need no additional abysses of space to account for them. (*Ibid.*, pp. 370-371.)

Argument 3. Even, however, if all these mutually confirmatory arguments could be dismissed as invalid, the mode of scattering of nebulae on the sky-surface would alone suffice to demonstrate their association with the sidereal system. Sir William Herschel was early struck with the occurrence of beds of these objects, preceded and followed by spaces void of stars. His assistant was indeed sometimes warned by him, not without good cause, "to prepare, since he expected in a few minutes to come to a stratum of the nebulae, finding himself already on nebulous ground." He attained, too, a partial comprehension of the larger plan of their distribution, as being the *inverse* to that of the stars; but the younger Herschel first brought into clear view the distinct and striking division of the nebulae into "two chief strata, separated by the Galaxy." Taking the circle of the Milky Way as a horizon, he remarked that the mass of them gathered together in Virgo and Coma Berenices "forms, as it were, a canopy occupying the zenith, and descending thence to a considerable distance on all sides, but chiefly on that toward which the (celestial) north pole lies." This characteristic accumulation about the Galactic pole is less marked in the southern hemisphere, though here too there is a "chief nebular region" approximately corresponding to that in Virgo. (*Ibid.*, p. 371.)

Of these three arguments against the Island Universe Hypothesis, namely:

1, the extraordinary brilliancy which must be attributed to Nova Andromedæ (1885) on the hypothesis; 2, the complex appearance of the great Magellanic Cloud, which implies that some apparent nebulae of the irresolvable sort may be closer to us than many objects which consist of easily separable stars; and 3, "the mode of scattering of nebulae on the sky surface," or one seemingly antagonistic to that of the stars; Miss Clerke evidently considered the third the most important, since she says, that it "would alone suffice to demonstrate their association with the sidereal system." A similar view was held by

Mr. Herbert Spencer, who wrote in 1854, as quoted by Miss Clerke,

In that zone of celestial space where stars are excessively abundant, nebulae are rare; while in the two opposite celestial spaces that are furthest removed from this zone nebulae are abundant. Scarcely any nebulae lie near the Galactic circle; and the great mass of them lie round the Galactic poles. Can this be mere coincidence? When to the general fact that the general mass of nebulae are antithetical to the general mass of stars, we add the fact that single nebulae are habitually found in comparatively starless spots, does not the proof of a physical connection become overwhelming? (*Ibid.*, p. 372.)

After such "overwhelming" testimony, it might seem rash to contest the conclusions of experts of such authority. But in the first place, as I pointed out in 1913 (in *The Popular Science Monthly* for March, p. 291) the argument for the Galactic association of the nebulae is by no means compulsory or conclusive.

Two different phenomena have been confounded. One is the fact discovered by Sir William Herschel, that stellar vacuities are often closely adjoined to nebulae. The nebulae thus characterized may, indeed, be associated with our Galaxy. The vacancies among the stars, with or without nebular accompaniment and with various degrees of obliteration of the stellar background, are found abundantly in the Milky Way. They were studied by Ranyard in his completion of Proctor's "Old and New Astronomy," and have been shown in numerous examples in Barnard's photographs. There can scarcely be a doubt that the stellar vacuities are due to dust-clouds, obscuring the more distant stars, and that the clouds are relatively near at hand.

The other phenomenon, that of the gathering of the white nebulae about the poles of the Galaxy and their absence from the Galactic zone, is simply an effect of the obliteration of

these very distant and faint objects by a great discoidal dust-cloud which exists like a ring around the Galaxy in extension of its plane. Similar dust-rings, invisible except by the obscuration which they produce, encompass many white nebulae in specimens which are disks seen on edge, and which show a central black band in the direction of the longer axis of the foreshortened luminous disk, bisecting the latter if we are exactly in its plane. Like W. Herschel's vacuities preceding and following certain nebulae, these dust-clouds belong with the luminous part of the aggregation. Similar dark rings being an invariable, at least a very frequent appurtenance. And the dust-clouds, associated with the gaseous nebulae, belong to our Galaxy and are now known as dark nebulae. They seem to increase in density in the direction of its plane and out beyond the limit of its great gathering of stars. Yet they may be said to be near at hand, astronomically speaking, though the total diameter of the dark ring may perhaps be several times that of the luminous part of the aggregation. Similar dark rings being associated with the white nebulae, they and the dark ring which surrounds our Galaxy and blots out the distant white nebulae in the direction of its plane and through a width on either side which tells us the transverse thickness of the cloud, belong together, in the sense that they are separate instances of the same phenomenon. But instead of the absence of white nebulae from the Galactic zone, proving that the white nebulae belong to our Galaxy, as Herbert Spencer thought, the fact proves that they do *not* belong to it, and favors the supposition that they may be similar but more distant aggregations. Let us then without more ado, subject the problem to a different test.

In 1913 I wrote:

It is obvious that we require for this investigation of external galaxies some scale of distances, and equally obvious that at present such a scale can be only approximate. Indeed, it is prob-

ably the uncertainty as to the scale on which the universe is constructed which deters astronomers from attempting to discriminate between different galactic orders. I propose to see if this uncertainty can be, in part, removed. I propose to take the distance of the *Andromeda* nebula as our celestial "yardstick," which may be called one *andromede*, and assuming that when we consider a large number of nebulae, the average size does not vary with the distance, and that consequently the average distance may be taken inversely proportional to the angular diameters of the objects. I shall classify the nebulae according to apparent size and brightness. It is essential that the sub-division shall not be too minute. There is in nature a tendency to wide variation, coupled with a coördinate tendency to uniformity in averages, when the number of classes is limited. Thus the land animals range in size from elephants, say fifteen feet long, to mice and shrews of a few inches. If we divide the earth into a good many faunal regions, the average sizes of the mammals in the different provinces may vary considerably; but if we divide the earth into only two halves, the averages will be almost identical. (Popular Science Monthly, March 1913, pp. 294-295.)

Acting on these principles in my paper, "Are the White Nebulae Galaxies?" (*Astronomische Nachrichten*, Nr. 4536, November, 1911), I divided the nebulae in Sir John Herschel's "General Catalogue of Nebulae" into thirteen sections, each of 400 Catalogue numbers, and treating each section exactly alike, obtained thirteen distinct and independent results. All nebulae 3' or over in diameter were called "large." Those of less than 3' diameter in the longest dimension were called "small." Herschel divided the nebulae into ten grades in respect to brightness. I reduced these to three grades in order to diminish the number of distinctions, as follows:

Very faint (<i>vf</i>)	= Sir John Herschel's grades 1 to 3
Faint (<i>f</i>)	= Sir John Herschel's grades 4 to 6
Bright (<i>b</i>)	= Sir John Herschel's grades 7 to 10

As thus classified, the ratios of the numbers of nebulae in different groups were taken with the following result:

Ratio of numbers (small divided by large).

Catalogue	Number	vf	f	b
1 —	400	7.90	6.38	1.00
400 —	800	7.15	3.47	1.41
800 —	1200	12.90	6.75	0.83
1200 —	1600	9.64	8.80	1.86
1600 —	2000	7.40	22.67	0.59
2000 —	2400	6.68	3.35	0.84
2400 —	2800	10.00	4.05	1.88
2800 —	3200	2.83	5.31	0.80
3200 —	3600	12.31	7.13	2.00
3600 —	4000	9.47	3.68	1.50
4000 —	4400	7.18	7.22	1.13
4400 —	4800	7.53	7.53	4.50
4800 —	5057	8.00	8.00	0.88
Mean of ratios		8.38	6.83	1.48
Ratio of sums		7.51	5.22	1.18

The general result is that the ratio of small to large nebulae is quite different for the several orders of brightness. This holds good for every one of the thirteen sections under which the observations are grouped. Without exception all show that faint nebulae are relatively more numerous among the small nebulae. Bright nebulae are nearly equally divided among the two classes. Consequently, some of the nebulae are either actually as well as apparently small, or else the stars of which they are composed have a greater average brightness; but the variation of the ratio (small nebulae to large nebulae),

$$vf : f : b = 6 : 4 : 1$$

shows that the fainter objects preponderate notably in the class of small nebulae. Unless the smaller nebulae are at the same time both smaller in linear diameter and also composed of either fewer or fainter stars, their light has suffered extinction. But if the composition of these aggregations is on the whole about

the same everywhere, there is no reason to suppose that the real dimensions of the nebulae bear any systematic relation to their distance. If they are distributed indiscriminately in regard to actual size, the average apparent diameters of a sufficient number of nebulae must be regarded as inversely proportional to their distance. The conclusion follows that the lessened light of the apparently smaller and really more distant objects has been diminished by absorption in its passage through space. (*Ibid.*, p. 445.)

A similar investigation was made of the much fainter objects found in the "Catalogue of New Nebulae Discovered on the Negatives" in Volume 8 of the "Publications of the Lick Observatory." These were taken with the Crossley reflector, about two-thirds of the plates being secured by Professor Keeler and the rest by Mr. Perrine. The latter estimates that there are half a million similar objects within the range of this instrument. The present specimen numbers 744 objects. Treated in the same way as the Herschel catalogue, I "divided these nebulae into two groups—those which are very small, or less than one-half minute in diameter, and those which are large, or more than two or three minutes in diameter. These classes are again divided into two, namely, very faint (including those that are listed as very faint and very, very faint, or which are approximately equal to stars between the 17th and 19th magnitudes) and pretty bright (including all of the 16th magnitude or brighter, which may be called faint to bright).

"The general result for the Lick Observatory catalogue is that, of the large nebulae, three-fourths are pretty bright and one-fourth very faint, while the very small nebulae have just the opposite distribution of brightness, three-fourths of them being very faint, and only one-fourth pretty bright."

When the relative distances in the two catalogues are adjusted so as to make the transmission curves congruent, the coefficients of transmission may be represented by a single logarithmic curve. Taking the coefficient of transmission,

$t = 0.996$ for a distance of one andromede = a , I obtain the following values of the transmission $(t)^a$ at the several nebular distances:

Nebular Class	Distance	Transmission
Unit distance	$a_1 = 1$ Andromede	$t = 0.996$
Large (Herschel)	$a_2 = 62.5$ Andromede	$t^a = 0.778$
Small (H) = Large (L)	$a_3 = 125$ Andromede	$t^a = 0.606$
Small (Lick)	$a_4 = 625$ Andromede	$t^a = 0.082$

The same statement can be made for the Lick catalogue and for Herschel's, if we put the fraction $2/3$ in place of $3/4$.

These results demonstrate two things:

1. That there is a gradual obliteration of light in passing through space which cannot be a selective absorption by rarified gases nor by material particles of any kind, neither can it be a transformation of light into heat for reasons which have been assigned.

2. To the extent of several million, at any rate, the existence of Swedenborg's "innumerable galaxies," or if you prefer Sir William Herschel's subsequent designation, "island universes," is a fact.

It remains to find the value of the andromede or unit of nebular distance. Several attempts to find this distance have been made by various investigators (including one by myself) with results so hopelessly discrepant as to cast doubt upon them all. Finally a method has survived which seems trustworthy. Miss Leavitt's photometric observations of the Cepheid variables at Harvard Observatory indicated that "the brightness and the length of the period are so closely related that if one is known, the approximate value of the other may be inferred. For an increase of one magnitude in brightness at maximum or minimum, the logarithm of the period increases by about

0.48. It seems possible that all these variables are of similar mass, those whose periods are long having slight densities, and *vice versa*." (Astron. Soc. of America, Vol. 2, p. 62.)

It appears that although gravitation tends to gather in fresh material and increase the mass of bodies, yet there is a limit beyond which this acquisition cannot go; because further increase of the mass produces an unstable explosive star and dissipates the extra material, either by a succession of minor operations, or by one great effort which splits the star in two. The latter, judging from the frequency with which binary stars occur, appears to be a rather common phenomenon.

Shapley, in his extensive investigations of the variables in star clusters, developed a method, founded on these principles, which is probably the most trustworthy that we have for finding the distances of these bodies. "Although the periods, ranges, and maximum magnitudes of the variables differ, their median magnitudes are constant for each cluster, though they vary from one system to another. Moreover, the median magnitude appears to be definitely related to the magnitudes of the brightest stars in the cluster [which are almost always of the giant class]. If the obvious assumption that differences in the median magnitudes are due entirely to distance is correct, then not only can we derive relative parallaxes as soon as the apparent magnitudes have been measured, but, with the derivation of a value for the actual luminosity of such variables, we can also obtain very accurate distances for all clusters containing typical variables, as well as for the isolated variables of this class." (Mount Wilson Solar Observatory, Director's Report for 1917, p. 219.)

In "The Solar Parallax and its Related Constants," by Professor William Harkness, the value of the astronomical unit, or mean distance from Earth to Sun, as determined up to 1891, was given as $149,340,870 \pm 96,101$ km., of which

barely four figures are significant. For such vast distances as we have to deal with in the starry spaces, the light-year, or distance traveled by light in one year, is much used. The sidereal year equals 31,558,149.314 mean solar seconds. The velocity of light is $299,877.64 \pm 80.019$ km./sec., according to the same authority. The product of these two numbers, divided by the number of kilometers in the astronomical unit, gives us one light-year = 63,369 astronomical units. Another unit which has recently come into vogue is the parsec, or distance of a star whose parallax is one second of arc, which is equal to 206,264.8 astronomical units, or one parsec = 3.2550 light-years. It is close enough to remember that a parsec is three and a quarter light-years.

Dr. Edwin Hubble of the Mt. Wilson Observatory has obtained photographs of the Andromeda nebula with the 100-inch Hooker telescope—the largest and most powerful in the world today—which show that it contains three or four thousand millions stars, not quite as many as are in our Galaxy, but a number of the same order. Some of these stars are Cepheid variables, which, tested by the method just described, all agree in making the value of the andromede about 930,000 light-years, or 286,000 parsecs. As this is nearly three (2.86) times the distance assigned by Miss Clerke, the real brightness of Nova Andromedæ (1885) must have been $(2.86)^2$ or 8.18 times that of the “318,000 stars like Regulus,” to which she compares it. The only escape from this conclusion is that either this star did not belong to the nebula, in spite of the fact that it was at an angular distance of only a few seconds from its very center, and of the further fact that novas are uncommonly abundant in this nebula, and that on the contrary it was really a galactic nova in spite of its not being situated in the Milky Way, thus constituting a further anomaly; or else this nova belongs to an entirely new and so far unique

species. Let us assume that the nucleus of the nebula is of extraordinary stellar density and that, while elsewhere the stars are too far apart to ever interfere, here, by exception, two stars have met in head-on collision. The result is annihilation, both of the stars and of the very atoms, and the dissipation in a brief interval of enough energy to last for ages of ordinary development. Either of these explanations may be considered exceedingly improbable, but equally improbable is the event, and yet it happened.

The nearest approach to such an occurrence was the appearance of a nova at the center of the globular cluster Messier 80 = N.G.C. 6093 on May 18, 1860. This, however, was much less remote and not nearly as bright absolutely. The peculiarity of the nova of August 31, 1885, was noted at the time. "The spectrum of Nova Andromedæ," says Miss Clerke, "was of a dubious character. It bore witness to a completely different order of incandescence from that of the 'blaze stars' in the Northern Crown and the Swan. The bright rays which it probably included were inconspicuous. Dr. Huggins, on September 9, was nearly sure of the presence of several in the green and yellow; and Doctor Copeland succeeded with difficulty on September 30, in getting rough measures of three accessions of light, one of them near the place both of the chief carbon-fluting (at 5164), and of a 'maximum' measured by Mr. Taylor, long after the disappearance of the star, in the spectrum of the Andromeda nebula. Resemblance in quality of light was, indeed, one of many arguments proving the physical relationship [in the opinion of Miss Clerke] of the two objects. This was, however, superfluously certain. It is barely conceivable that *one* stellar conflagration should by chance be projected almost accurately upon the core of a nebula in reality quite disconnected from it; but that *two* such highly improbable events should come

within twenty-five years of each other may fairly be called impossible. The novæ of 1860 and 1885 were then situated within the substance of the nebulae they temporarily illuminated." (System of the Stars, pp. 105-6.)

Whether Miss Clerke would have remained of the opinion that the novæ belonged with the nebula, with all that this implies, after the nebula has been shown to be a galaxy, which she believed to be impossible, may not be certain; but as in correspondence with her I always found her open-minded, I am confident that she would have found the solution of the puzzle not as simple as she at first thought.

It will be recognized that I have entirely abandoned my earlier view that the Andromeda nebula (as well as the stars of the Galaxy) is at a distance of only a few thousand light-years, basing my conception (as did Mr. T. Ellard Gore) on the improbability that Nova Andromedæ should have the brightness which it must have had if at a greater distance, and on the further improbability that the nova is *not* a nebular object, both of which conceptions are justified on general principles, though one or the other of them must now be abandoned.

Miss Clerke's objection that "the Andromeda nebula, if an external galaxy, would almost certainly be at a far greater remoteness from a sister-galaxy than would be represented by twenty-five of its own diameters," must likewise be abandoned, since her estimate of the Galactic diameter must be increased to $930,000/25 = 37,200$ light-years, while recent estimates give at least 50,000 light-years. Kapteyn's preliminary value of the total number of stars in the Galaxy is 47.4×10^9 , or more than ten times as many as are in the nebula. Consequently the Galaxy appears to be the more widely extended of the two, and as various facts of observation suggest a continual expansion of these great aggregations, we must presume that the Galaxy is the older of the two. The same conclusion fol-

lows from Dr. Hubble's observation that twenty-three new stars have appeared in the nebula in the last two years, indicating a youthful activity, far exceeding that of our system. Moreover, the strong central condensation of many of the white nebulae, as compared with the absence of any very definite nucleus in our system, implies reserve sources from which further development of energy will proceed, while our Galaxy, though still containing some youthful stars, on the whole, is very ancient and is on the wane. Another indication of this is the observation of Seares, that the intrinsic brightness of typical star-clouds in the Milky Way is much less than that of some of the white nebulae which ought to be comparable.

I think there can be no doubt whatever, that the distances between the external galaxies are small compared with their diameters. As I said in my paper on "The Luminiferous Ether,"*

Considering that the parallax of the nearest star is almost one second of arc, if we represent the disk of a star 1,000,000 km. in diameter by a little circle of one mm., we should have to place a similar dot representing the next nearest star at a distance of $(92.8 \times 206,265) 10^6$, or about [191 miles = 308 km., equivalent to one parsec on the scale of the drawing away beyond any risk of jostling!]; and granting that there may be regions in the Milky Way where the star-density is 1,000 times as great as in our neighborhood, yet even then the dots would be almost 20 miles apart. This gives a startling picture of the sparsity of stellar material. . . . On the other hand, if we let a millimeter dot stand for a galaxy, neighboring galaxies will be represented by similar dots sprinkled only a few centimeters apart; and since these objects have velocities of upwards of 1,000 km. per sec., frequent collisions are inevitable unless there are mutual repulsions which develop upon arriving at too close proximity. This result might, however, be produced in another way, provided gravitational attraction by which we assume the stellar

* Occasional Scientific Papers of the Westwood Astrophysical Observatory, No. 2, pp. 42-3.

movements are given, is not universal, but is limited in its action to definite volumes around each galactic center, within which gravity is controlled by definitely limited currents of the aura. In fact, the great velocities which are exhibited by certain of the white nebulae do not necessarily imply that the motions have been imparted by the attraction of masses enormously greater than that of our Galaxy. The entire field of gravitational potential energy belonging to a given galaxy being borne by a limiting volume of surrounding aura, we may presume that if this volume of aura has a motion of its own, the system of enclosed material particles will necessarily follow. The galactic multitude will be carried along as if it were so much floating material borne on a supporting current of the universal medium to which each particle is intimately attached by its very constitution, though the cause of the motion is not to be sought by pressure in currents of immediately juxtaposed aura, but in more extensive aural currents, with which the matter is connected through fields of force.

The numerous small nebulae within the 42 square degrees of the larger Magellanic Cloud, to which Miss Clerke refers, are not of galactic dimensions, since the entire aggregation has a diameter of about 14,000 light-years and is much smaller than the Galaxy. Its distance is about 100,000 light-years, and both the larger and the smaller Magellanic Clouds appear to be minor galaxies or satellite bodies, torn off from the parent Galaxy, possibly of different composition and almost certainly of different structure and mode of development. That they should contain still smaller nebulae, star-clusters and star-clouds, is not strange, seeing that the parent body does the same. The minor details, however, are very peculiar. The two small nebulae, Messier 32 and N. G. C. 205, may possibly bear the relation of a pair of satellites to the great Andromeda nebula but we do not yet know their actual distances.

“The spectrum of the Andromeda nebula is a pure stellar type with no indications of blended absorption lines of different spectral types such as are shown by spectra of the globular star

clusters; and the Flagstaff plates show no traces of the bright lines." (Slipher.) The last refers especially to bright lines of the Wolf-Rayet type of stars and of the gaseous nebulæ; but it is certain that the nebula contains stars of several types, since Cepheid variables and novæ have already been distinguished. In general the integrated spectrum most nearly resembles that of stars of the solar type, but other nebulæ show several variations.

Their spectra show that the white nebulæ are of distinctly stellar type, though of several sorts. *Their velocities far exceed those of the stars in our Galaxy.* Hence they do not belong to our Galaxy. They are external galaxies. Swedenborg is completely confirmed in this respect.

Perhaps one of the most striking confirmations of the view that the white nebulæ are distinct individual entities with unequaled freedom from control by any other bodies is the fact that so many of them are spiral nebulæ, each with its own independent rotation, self-controlled and self-originated; for the only way to account for this is by means of interior explosive forces which start the mass whirling. The source of motion is from the inside and not from without. Visual inspection vouches for the fact that somehow and at some time, rotation has been started, at least in the spirals, and probably in the spindles which presumably are spiral disks seen on edge. Velocities in the line of sight, spectroscopically determined, give confirmation of the rotation in several cases, but the observation is a very difficult one.

Confining our attention to the nearer stars of our Galaxy, while there is a certain amount of haphazard motion for which Kapteyn has deduced from the Lick measures an average velocity of 10.3 km./sec., there is also a very remarkable systematic movement of groups of stars. Proctor first called attention to the phenomenon of star-drift. Further study of

these drifts, of which two, those of the taurids and the ursids, dominate all the rest, have disclosed that this star-streaming consists of two equal and opposite associated movements, apparently two equal and opposite revolutions about a common center, situated about 650 parsecs from us in right ascension $23^h 10^m$ = Galactic longitude 77° and declination $+57^\circ$ = Gal. latitude -3° . The movements are precisely in the plane of the Galactic equator at average velocities of 19.5 km./sec., so that the relative motions of the two groups will be $2 \times 19.5 = 39$ km./sec. This reminds one of the equal and opposite rotations which a magnetic field imposes upon the atoms.

Another distinction of the rotating galactic disks is the ring of dark and probably meteoric material by which they are surrounded in the equatorial plane. These, when the disk is presented edgewise, form a dark central belt. A list of such seemingly divided nebulae is given by Heber D. Curtis from the Lick photographs:

N. G. C. 891 4013 7814 4565 5866 4594 5746 3628
4517 5907 4402 4244 3718 2146 4388 2968 4526 4282
678 169 3556 4631 3623 2683. The phenomenon to which Herbert Spencer called attention, instead of being a proof that the nebulae cannot be external galaxies, will almost serve as a criterion of their externality.

Where the disk is not seen on edge, we can still sometimes get indirect testimony for the existence of a dark ring. The oblique presentation of the disk without an additional criterion would not tell us which half was tilted toward us. But if there is an external dark ring it may come between us and the advanced half of the disk and obscure it. This method has been applied successfully by Dr. Slipher. (See Publications, American Astronomical Society, Vol. 4, p. 232.)

Among the irresolvable white nebulae a considerable class has the spherical shape like the globular star-clusters. Here the

internal explosive forces have acted equally in all directions. There may be a slight tendency to rotation but not enough to develop disks and spirals.

The full force of my cosmological argument can be seen from the series of papers: 1. A Cosmic Cycle; 2. The Conservation of Mass and the Passing of Matter; 3. What Becomes of the Light of the Stars?; 4. The Wasting of Stellar Substance; 5. On a Possible Limit to Gravitation. If matter is being destroyed in stellar foci, it must be reproduced elsewhere. I point to the enormous outpouring of radiant energy from the sun and stars as the product of the destruction of atoms and attribute the atomic renewal to the reabsorption of the resulting luminous energy by the aura (called by Sir Oliver Lodge the "ether of space"). I have shown that the universal interstellar atmosphere is "the great storehouse of energy." The whole theory includes: 1. The existence of an interstellar atmosphere—the aura—whose reality was made known by Swedenborg. 2. The formation of matter out of the aura by the action of light, not distinctly asserted by him; but it seems to me to be a matter of logical inference from his great doctrine of creation by influx from the spiritual Sun through emanations in a series, embodied in atmospheres arranged in discrete degrees. 3. The destruction of matter, with the setting free of its energy of formation, to produce the heat of the stars, which in turn sends forth the light and completes the work.

The acceptance, or partial acceptance of the theory, a bit at a time, has been a long time in coming. Before the appearance of my "Cosmic Cycle," the atoms were believed to be eternal and solar radiation was attributed to heat produced by the sun's contraction. But this allowed for a duration of sun and earth which was altogether too short. The geologists protested. Lord Kelvin's "20,000,000 years" of solar heat

needed to be expanded to hundreds of millions of years, and this my theory has accomplished.

As showing a way out from a previously unsolved dilemma, such an explanation deserves better reward than to be called a "speculation." But is it merely that? The old "contraction" theory is really much more speculative, for no one had ever observed any contraction in the sun. But there are actual observations that the older stars are less massive than the newer ones and also that *they are moving more rapidly*. This they should do if their mass has diminished by actual destruction of material. For since momentum of a freely moving body does not vary, and momentum is equal to mass multiplied by velocity, if a portion of the mass has been annihilated and its subatomic energy converted into radiation, it follows that the velocity must be increased proportionally, so that mass times velocity may continue constant. Observation confirms this foreseen result and in my opinion demonstrates the truth of the theory, which is *not* a mere speculative hypothesis.

Other facts are known which tend in the same direction. The mere breaking up of the radio-active elements without actual destruction of their substance produces greater amounts of energy than can be obtained in any other way now known. And this breaking up is attended by a production of helium. The further fact that helium is very abundant in the hottest stars points to the presence in them of large quantities of unstable elements. This alone would not prove that any of their substance has been destroyed, but taken in connection with the demonstration already given by a progressive diminution of mass, the initial disintegration appears to be the beginning of a process of final complete dissolution.

And why not? "The heavens wax old as doth a garment." And what could be more fitting than that their restoration should be by means of light? Spiritual uncreatable light from

the Sun of Heaven and natural light from the dead and dying material suns which in their death provide for the continuance of receptacles of the one only living substance. "In the beginning . . . , God said: Let there be light."

In considering further Swedenborg's majestic conception of external galaxies indefinitely repeated, characterized by Miss Agnes Clerke as a "notion" and stigmatized as "grandiose" and "misleading," epithets which in view of what precedes must surely be admitted to have been harsh and ill-advised; far-reaching changes in the distribution and manifestation of energy in time and space must be taken into account.

THE AGE OF THE STARS AND THEIR STORY

The heavens "shall wax old like a garment;
As a vesture shalt Thou change them, and they
shall be changed." (Psalm cii, 26.)

The gaseous nebulae are so closely consociated with the Milky Way and are so interwoven with its structure, that they obviously form a part of it. Gaseous nebulae having bright-line spectra are often, perhaps always, associated with clouds of meteoric dust. Attrition of the particles of interpenetrating streams produces electrification and rise of temperature, which need not at first be very high, for luminescence under electric influence takes place at low temperatures. Eventually, if the swarm is dense enough, the temperature will rise until vaporization results and we have a gaseous nebula. Otherwise the presence of the dust-cloud is only known by its blotting out the light of more distant luminous objects, whether stars or nebulae. "Since there exist these enormously extended masses of gaseous or misty material, capable, whether themselves luminous or dark, of exerting a strong absorption upon the light of any bodies beyond them, and intimately associated with the Milky Way; and since further, it is inevitable that the broad disk of

the galactic accumulation must have gathered into its vicinity great swarms of meteoric material, acting after the manner of a general, widely distributed mist, forming an envelope analogous to an atmosphere, having its greatest depth in the direction of the galactic plane; it follows that this extensive quasi-galactic atmosphere and its associated, but locally limited, gaseous bodies must especially absorb the light from those distant galaxies which lie in or near the plane of the Milky Way."*

We have seen that such dust-clouds are so common an accompaniment of the distant galaxies as to be almost characteristic of them. Such remnants suggest that the entire galaxy may have been produced from a great meteoric swarm, as in Sir Norman Lockyer's "Meteoritic Hypothesis." Figure (13), reproduced from "Photographs of Nebulæ with the 60-inch Reflector, 1911-1916," by Francis G. Pease (Mt. Wilson "Contributions," No. 132) represents the spiral nebula, N. G. C. 4594 Virgo. Its angular dimensions are $7' \times 1'$. It "is seen almost edge-on, the convolutions being so nearly concentric, that it is not possible to state whether it is right- or left-handed." The obscuration by the dark band is complete, save that "a trace of nebulosity runs almost centrally along the dark streak." The integrated spectrum is F_5 , or a little less advanced than that of our Galaxy. Moreover, it has a brilliant central condensation which betokens relative youthfulness. The radial velocity is 1180 km./sec., "and the rotation, at a distance of $2', 330$ km., the W. side approaching and the E. side receding from the observer."

Besides the more general dust envelope encircling the galaxies, there are local clouds of dust, "dark nebulae," as well as masses of luminous gas, the bright-line nebulae, interwoven

* "What Becomes of the Light of the Stars?" p. 291.

among the groups and streams of stars which make up the Milky Way. Of these complex masses, A. C. Ranyard writes in his completion of Proctor's "Old and New Astronomy":—"The Milky Way is like sand, not strowed evenly as with a sieve, but as if thrown down by handfuls (and both hands at once), leaving dark intervals, and all consisting of stars of the 14th, 16th, 20th magnitudes down to nebulosity, in a most astonishing manner. . . . There must be millions on millions, and all most unequally massed together, yet they nowhere run to nuclei, or *clusters much brighter in the middle*. This extraordinary exhibition terminates about the eighteenth hour of R. A., where the Milky Way resumes its usual appearance. The Sagittarius region of the Milky Way referred to above . . . contains stellar structures which seem to afford evidence of the projection of matter into a resisting medium. As the tree-like forms in the great Orion Nebula and the forms of the structures in the [solar] Corona bear witness to explosions on a colossal scale that have taken place below their bright bases, causing a stream of matter to be projected upwards, which stream has subsequently been divided and its branches deflected from their original course by a resisting medium, so the tree-like forms [in the stellar streams] afford evidence of the projection of matter into a resisting medium extending through that region of the Milky Way." (pp. 737-8.)

The limits of the visible universe are not determined by the power of gravitation to control and marshal the starry hosts, for already we have indications that there are boundaries beyond which gravitation cannot act. Possibly the dimensions of a Galaxy may very nearly cover the space within which gravitation can function. There are indications that at greater distances the aggregations *repel* each other. It is impossible for them to clash, because their mutual repulsion keeps them somewhat uniformly dispersed. Moreover, beyond a distance

of some hundreds of millions of light-years, the light of the stars becomes sensibly extinguished by absorption and there is limitation in another way, if, indeed, space itself be not limited by its fundamental properties, as Riemann supposed and as Simon Newcomb taught.

From spectroscopic measurements of velocities in the line of sight, W. W. Campbell has obtained these average values:

Type of Star	Radial Velocity (km./sec.)	No. of Stars
B	6.52	225
A	10.95	177
F	14.37	185
G	14.97	128
K	16.8	382
M	17.1	73
Planetary Nebulæ	25.3	12

From several hundred binary stars, for which the masses and absolute stellar magnitudes have been obtained by Jackson and Furner, and from extensive data collected by Kapteyn and Adams for more than a thousand single stars, Professor F. H. Seares obtains the following approximate mean masses and absolute stellar magnitudes: It should be noted that a star halfway between the A type (strong hydrogen lines in the spectrum and high temperature, the "Sirian" type) and the F type (metallic lines becoming numerous, hydrogen lines less prominent and temperatures lower, the "Procyon" type) is listed as A₅, etc. Also that stellar magnitudes are given on a logarithmic scale, where negative values denote the brightest stars and large positive numbers signify very faint stars. The absolute magnitudes are those which the stars would have if all were at a uniform distance, corresponding to that of a star

having a parallax of one-tenth of a second, distance = $32\frac{1}{2}$ light-years.

Spectral Type	Mass	Absolute Stellar Magnitude
B ₀	18	-1.60
B ₅	14	-0.20
A ₀	10.5	+0.70
A ₅	6.9	+1.50
F ₀	4.4	+2.40
F ₅	2.7	+3.32
G ₀	1.7	+4.35
G ₅	1.3	+5.20
K ₀	1.2	+5.90
K ₅	1.1	+7.10
M _a	1.0	+9.80

The very massive B-type stars have been called "giants" by Herzprung and Russell, and the temperature of their outer radiant layers may be as great as 20,000° Cent. But not all of the giant stars are hot. Some of them are of the M-type and are just beginning to shine; though being greatly expanded their total brightness may be large, even though their intrinsic luminosity is small. The spectra of the M-type stars are characterized by absorption bands of titanium oxide, their outer layers being cool enough to permit the formation of a few compounds. The existence of giant stars has now been completely demonstrated through the direct measurement of several stellar diameters by means of Michelson's stellar interferometer. Betelgeuze (alpha Orionis) is found to be 252 times the diameter of the sun, or $252 \times 865,000 = 217,980,000$ miles. Arcturus (alpha Boötis) measures 25 times the solar diameter, or 21,625,000 miles. Antares (alpha

Scorpii) has 437,690,000 miles to its diameter. These numbers are subject to slight changes as the method becomes perfected and more powerful apparatus is made. For instance, the most recent measurements at Mt. Wilson give for the parallax of alpha Orionis $+0''.017 \pm 0''.002$, and for the linear diameter of the star about 245,000,000 miles.

That the stars have commenced as meteoric swarms, condensed or precipitated out of the primitive gaseous nebula, is further indicated by the great expansion of the M-type giant stars which form the earliest *stellar* stage, according to the theory. Densities of a ten-thousandth or a hundred-thousandth of that of the sun are met at this point. When the condensation and gaseous pressure become so great that the atoms begin to press on one another and become distorted, the atoms commence to break up. The radiation from the giant and much expanded stars may come from a slightly thicker layer, but in any case the radiant layer is of slight depth. "Anderson finds that a few centimeters of the vapor of iron, formed by the electric explosion of a fine iron wire, are completely opaque and emit a continuous spectrum which is not produced by a broadening of the iron lines, for these are still visible as fine dark lines from an excessively thin cooler marginal layer. The pressure is estimated to be about 20 atmospheres, and the collisions between the atoms at this pressure and at the estimated temperature of $20,000^{\circ}$ K. are sufficiently numerous to set the thousands of mass-giving electrons within each iron atom oscillating under the tremendous impacts of the explosion. Here then is the source of the photospheric radiation, and we see that no great depth of gas is needed to produce it, if about 5 cm. of exploded iron vapor can give a good imitation of the sun's surface, and even exceed it in intrinsic brilliancy. The experiment overthrows the hypothesis that an enormous depth of gas is needed to produce the continuous spectrum through

broadening of the emission lines of a heated gas under pressure.”*

Anderson's experiment may not have produced atomic disintegration, but the much greater pressure in the helium, or B-type stars, which are the hottest and most massive of the stars, have accomplished this breaking up of atoms on a large scale.

Thence comes their great heat and the evolution of much helium gas. They are intensively explosive stars, often fissured into spectroscopic binaries of short period and close approach at perihelion passage, attended by notable eruptions of gas, or they may be occulting pairs of the Algol type. Some of these variable stars are of the Cepheid variety and pass through periods of gradual contraction, followed by sudden explosive expansion as the unstable ingredients return into proximity. In the course of ages the unstable material is gradually eliminated. The period which at first had diminished as the star approached the summit of its power, increases as the star reddens with age. The mass has diminished and the density is increased. The star has become a dwarf. The giant stage is succeeded by a series of dwarf stages with increasing density and continually diminishing mass. The brightest stars in the globular clusters are redder the brighter they are. Here the stars owe their brightness not to intrinsic luminosity, but to the great extent of radiant surface which they expose. The stars of the globular clusters are largely giants. The total brightness of the cluster, which may exceed that of 250,000 suns, does not mean there are as many stars. On entering the category of dwarfs, the order is inverted and very red stars are among the faintest.

A planetary nebula is a spherical cloud of dust resulting

* F. W. Very, *Pub. Am. Astr. Soc.*, Vol. 5, pp. 32-3.

from a central explosion. In some cases gaseous matter is mingled with the dust, giving a mixed spectrum of emission and reflection; but in others the dust merely reflects the light of the central star. The cataclysm stands at the end of a long career of development in which meteoric material has accumulated until the mass exceeds the conditions necessary for stability.

So far as is known, the usual sequence of a nova is its transformation into a planetary nebula or into a star with certain nebular characteristics, such as the Wolf-Rayet stars; and conversely we can have little reason to doubt that every planetary nebula has developed from a nova since they occur in similar situations. Novas appear suddenly and at first have many of the characteristics of the B-type stars, such as strong continuous spectrum in the violet and ultra-violet, indicative of high temperature, throwing off by pulsatory emission great volumes of hydrogen, helium, etc. The B-type stars have very little motion, and what there is, is mainly a reflection of the solar parallactic motion. On the contrary, the central stars of the planetary nebulae are the most rapidly moving of any Galactic objects. The B-type stars are very massive and the novas excessively massive. Nova Persei (1901) had about 1000 times the mass of the sun and Nova Andromedæ (1885) may have been equal to 100,000 suns. If so, its explosion would have been competent to originate a globular cluster as a component of its galaxy. According to Shapley the globular clusters are equivalent to 275,000 suns. If the energy expended in such gigantic explosions has been produced at the expense of the atoms of the nova destroyed, the formation of a shell of dust out of the widely dispersed remnants and the generation of a high velocity in the star itself through destruction of a portion of its substance, as previously explained, is what might be expected.

THE CASE OF THE SPIRAL NEBULAE

It is a curious fact that the tendency of scientific theory on cosmical subjects is to emphasize the concentrative forces and ignore the equally potent dispersive forces; whereas, as Ranyard has pointed out in the passages already quoted and as I have shown from numerous illustrations in my "Cosmic Cycle," while there is aggregation going on under the influence of gravitation, it is usually followed by dispersal. This tendency of scientific theorizing has been long-enduring. The most active of the electric particles were labeled "negative" and the name sticks in spite of its incongruity. Laplace attributed the origin of the planets to a falling inwards of a collapsing nebula, thus reversing Swedenborg's prior announcement of what is now seen to be the more probable theory, that the planets have been thrown off from the sun and have traveled outwards. Influenced by the same subtle tradition, Pease, in his valuable paper on the nebulae, selects the following definition:

"A left-handed spiral has been defined as one in which an object traveling inward along one of the arms moves in a counter-clockwise direction."

Although as a mere matter of geometry it is immaterial which of two opposite directions shall be called positive, still as every spiral nebula which has been examined hitherto has been found to have a motion along the arms outwards or *away from the center*, why not include this fact in our definition and let the center be the origin of spiral coördinates?

William Sutherland, in his paper, "Bode's Law and Spiral Structure in Nebulae" (Astrophysical Journal, xxxiv, p. 251, October, 1911) examined the forms of the spirals in spiral nebulae and found (as did E. d. v. Pahlen, in Astron. Nachr., Nr. 4503) that the spirals conform with reasonable accuracy to the equiangular logarithmic spiral. He is obliged to assume

	Ritchie's Messier 61 Canum Venaticorum					Ritchie's Messier 101 Ursæ Majoris					Roberts' Messier 100 Comæ				
\ominus	0	$\pi/2$	$2\pi/2$	$3\pi/2$	2π	0	$\pi/2$	$2\pi/2$	$3\pi/2$	0	$\pi/2$	$2\pi/2$	$3\pi/2$		
r in one spiral..	7	12	18	25		4	5	6	9	4	5	8	11		
r in the other....	7	11	19	28	60	4	5.5	8	5	9	..		
r mean	7	11.5	18.5	26.5	60	4	5.2	7	9	4	5	8.5	11		
r calculated	6.2	10.2	18.6	32.4	56	4	5.2	6.9	9.1	4	5.6	8	11.2		

In the first example r is calculated from the equation, $\log_{10} r = 0.79 + 0.24 (2\ominus/\pi)$ or $\log_e r = 1.819 + \ominus/2.84$. The last two samples are calculated from the equations, $\log_e r = 1.38 + \ominus/4.55$ and $1.38 + \ominus/5.69$.

"The spiralities of these three nebulae, measured by a in radians, are 2.84, 4.55, and 5.69, that for the ring nebulae being ∞ , with 0 for the case of a uniformly collapsing spherical nebula."

that the lines of luminosity agree with those of greatest density, which cannot involve any serious error. In this way he obtains values of the radius vector (r) in mm. for equal increments of the angle (Θ) from two photographs by Ritchie and one by Roberts.

Reasoning on the assumption that the entire phenomenon is due to the contraction of a material system, acted upon by the force of gravitational attraction, Sutherland expatiates as follows:

It is interesting to recall the fact that the logarithmic spiral is the orbit of a particle moving under an attraction varying inversely as the cube of the distance from the center. It appears then that, after the greater part of a nebula has gathered into a central star, we may regard the larger part of the gravitation as producing cohesion of the whole and along with the general rotation providing the general rigidity, while at the same time part of the attraction of gravity is so modified by collisional viscosity as to operate like an unresisted attraction varying inversely as the cube of the distance from the center. (*Loc. cit.*, pp. 258-9.)

The discovery that the forces acting in nebulae and directing their internal motions are not centripetal, but centrifugal, does away with the necessity for a supposed quasi-viscous resisting medium and for some other equally labored speculations.

The aura is the magnetic as well as the gravitational medium. Its magnetic properties are responsible for the limitation of gravity to a particular galactic "cell," and also for the appearance of an inverse cube of the distance in the law for the galactic spirals. Swedenborg's prevision that the Galaxy must be magnetically controlled becomes increasingly probable.

"Bode's" law had been previously announced by Titius, and as I showed in my notes to the Principia, something similar has been given by Swedenborg, but none of them had explained anything. Sutherland's explanation may possibly be valid for the solar system, but it is entirely inapplicable to the galaxies unless modified and turned into a magnetic explanation.

CHAPTER XII

SWEDENBORG'S TEACHING CONCERNING THE HABITABILITY OF WORLDS—HIS "EARTHS IN THE UNIVERSE"

IN his treatise "The Earths in our Solar System which are called Planets: and the Earths in the Starry Heavens with an Account of their Inhabitants and also of the Spirits and Angels there: From what has been seen and heard" (n. 26), Swedenborg tells us what he learned on this subject from the spirits of the planet Mercury, who are permitted to wander through the universe. It will be recalled that the ancients had their Mercury—he of the winged sandals—who was the messenger of the gods and the patron of learning, a conception which was doubtless bequeathed to them from an earlier time when there was open intercourse with the spiritual world. The prevalent naturalism of the day rejects everything not "seen and heard" with eyes and ears of flesh; but there are other ways of learning the truth, and there is a spiritual truth, discerned by the eye of reason, which is more fundamental than the fallacious appearances of naturalism.

Let us listen to what our universal guides have to say:

"In consequence of their thus journeying through the universe, and thereby being enabled to know more than others respecting the worlds and earths out of the sphere of our solar system, I have also discoursed with them," says Swedenborg, "on this subject. They said that in the universe there are very many earths inhabited by men; and they wondered how any suppose (whom they called men of little judgment) that the heaven of the Omnipotent God consisted only of spirits and

angels who come from one earth, when these comparatively are so few, that in respect to the Omnipotence of God they are scarce anything, nor would it alter the case even supposing there were myriads of worlds and myriads of earths. They declared, moreover, that they knew there were earths existing in the universe to the number of some hundred thousands and upwards; and yet what is this to the Divine Who is infinite?"

The spirits from Mercury knew from their own experience that there are *hundreds of thousands* of worlds. But their experience was still a limited one and so they said: "What is this to the Divine Who is infinite?" that is, what is this to the innumerable worlds known to God?

The late Alfred Russell Wallace believed that ours is the *only* inhabited globe! and this because he assumed that life had arisen from the fortuitous concourse of atoms, which would be so marvelous a thing that the chances would be myriads of myriads to one against its ever happening again. He could not deny that the seemingly impossible *had* happened on this Earth, but instead of being led to question the truth of his premises in respect to the dominance of a blind chance and the non-existence of a Divine Providence, he was ready to accept this bizarre conclusion.

The spirits of Mercury (who never forget anything) lavished much sarcasm on the denizens of a world whose memories are so deficient that they have to supplement them by written memoranda on pieces of paper.

There are some thousands of millions of stars in our Galaxy, and while many of them have not yet advanced to that stage in their evolution where they are attended by planets, and of these planets which no doubt accompany a great many of the stars (for the evidence in regard to the unity of plan of the stellar universe is overwhelming) only a part have reached the stage of serving to support a highly organized life, though all

may be destined eventually for human habitation, it is inconceivable that out of the planets accompanying this vast multitude of stars, only one should be inhabited. But Swedenborg's thought went still farther and took in *innumerable galaxies*, each with its hosts of stars and attendant planets (all, of course, serving as the basis of the angelic heaven of heavens). Once admit the reality of the Divine Providence and Omnipotence, and there is no limit to the marvels of the heavens. The plurality of worlds, announced by Swedenborg, ceases to be an anachronism and an improbability, and is only what we might expect.

Professor William James, in his "Varieties of Religious Experience," was of the opinion, that "though the scientist may individually nourish a religion, and be a theist in his irresponsible hours, the days are gone when it could be said that for Science herself 'the heavens declare the glory of God and the firmament showeth his handiwork'." (*Varieties*, etc., p. 491.) Again he says: "It is impossible in the present temper of the scientific imagination, to find in the drifting of the cosmic atoms, whether they work on the universal or on the particular scale, anything but a kind of aimless weather, doing and undoing, achieving no proper history, and leaving no result." (*Ibid.*, pp. 491-2.)

James was simply overwhelmed by the apparent cogency of the Darwin-Wallace argument for "natural" selection and the reign of blind chance, an argument which is shown to be untenable in my paper on "The Theory of Evolution" in the *New Church Review* for October, 1917. However, farther on (in a footnote, p. 501) this writer hazards a guess, that "thus the divorce between scientist facts and religious facts may not necessarily be as eternal as it at first sight seems, nor the personalism and romanticism of the world, as they appeared to primitive thinking, be matters so irrevocably outgrown.

The final human opinion may, in short, in some manner now impossible to foresee, revert to the more personal style, just as any path of progress may follow a spiral rather than a straight line. If this were so, the rigorously impersonal view of science might one day appear as having been a temporarily useful eccentricity rather than the triumphant position which the sectarian scientist at present so confidently announces it to be."

This rather hesitating and vague admission of a philosopher who is willing to remain "on the fence" in respect to a vital point of doctrine in this half-hearted advocacy of a *personal* supervision of creation—the new science of spiritual things founded on "things heard and seen" by a reliable witness, unhesitatingly rejects and in its place substitutes a whole-hearted acceptance of the reality of spiritual things which it proclaims as the only valid solution of a series of enigmas.

In Swedenborg's unrivaled testimony we have the most convincing proof that the inhabited worlds are, indeed, innumerable and they have not been formed by blind chance, but on the contrary, they have been created by means of the ordered plan and the systematic and perpetual provision of the Divine Omnipotence.

Nothing could induce me to wade through the enormous and tedious literature which Professor James must have studied to enable him to write his "Varieties of Religious Experience," but we should be grateful to him for having done the job and for giving us the results, though in many respects I cannot share his viewpoint. James defines religion as pious meditation, a certain sentimentality, a bit of self-sacrifice, prayer, etc., a modicum of which every reasonable person who wishes to live above the animal must practice; but these things can be easily overdone—and the result is the "saint" with whose description Mr. James' pages teem. In the main, he pictures the "religious" person as a pathological case and "gay ill to

ive wi'." The only sort of religion for which I have any use, namely that taught by Emanuel Swedenborg and summarized in his memorable epigram: "All religion is of the life, and the life of religion is to do good,"—Mr. James does not even mention among all of his "Varieties." Perhaps, considering the company in which I should find myself, I ought to be grateful to him for leaving my sort out. The pictures which he paints are those of the religious fanatics. We do not hear so much of those who simply go about the world doing good.

I do not agree to the statement on p. 491, that "the days are over when it could be said that for Science herself 'the heavens declare the glory of God and the firmament showeth His handiwork'."—Still it is true that "the undevout astronomer is mad!" There have always been atheistical scientists, but I refuse to be numbered among them. Joseph Blanco White, in his address to "Mysterious Night," pointed out truly that even light can deceive, though the remedy is *more light*.

When James alludes to life in our solar system as "a local accident in an appalling wilderness of worlds where no life can exist," he is evidently endorsing Alfred Russell Wallace's dictum, that, because the chances are myriads of myriads to one against the probability of life originating from the fortuitous concourse of atoms, our Earth must be the only inhabited earth in the universe. But this is complete folly. Henri Fabre, Prince Kropotkin, and others have shown how impossible it is that certain of the animal instincts can have originated in blind chance. This overthrows the whole superstructure based on the "blind chance" proposition, and eliminates the premise that there is such a thing as blind chance, playing the part of a cosmical director.

The multitude of stars exhibits similar spectra when individual stars arrive at the same stage of development. I would turn the probability argument the other way round, and would

say, that, since our sun is surrounded by planets, each planet being an inhabited world, other suns probably have planets in like manner, or will have them when they reach the same stage of evolution that our sun has attained.

Christian Wolff, who is derided on p. 492, seems to me to have had more wisdom than his critic; for, although James takes some exception to the so-called scientific attitude, he is evidently dominated by it, in spite of the admission in the footnote on p. 501, that "the divorce between scientist facts and religious facts may not necessarily be as eternal as it at first sight seems," and he tells us nothing of a truer science, more complete in every way, whose findings are not opposed to that genuine religion whose law is *use*. What would be the use of a planet, if it were not to support life?

If one's belief in spiritual realities were as thin and speculative as that of Professor James, it would seem hardly worth while to waste so much time on it. If religion is, indeed, as is suggested on p. 518—"a postulator of new facts," why not cut out all this speculation, confine ourselves to the facts, and build on these? James appears to say so, too, on p. 519. But at the end he is only just ready to begin! He admits that, after all, he may have to come to this, which was the only sensible thing to do at the start.

Let us then free ourselves from the dominance of naturalism and the materialistic philosophy. Let us adopt Swedenborg's method and follow his leadership, which is that of facts and of truths founded on facts. How else can we know anything about "Other Worlds than Ours" than through the testimony of a reliable witness who has seen and heard by more potent senses than those of the physical body? These can only testify to sensual appearances which are apt to be misleading and require rational interpretation. The sensual appearances can often be taken to confirm the higher revealing, if judiciously

interpreted. But taken by themselves, how conflicting and untrustworthy have they been!

Venus and Mercury have been supposed to be scorched by the sun's rays and, therefore, to be uninhabitable! Jupiter and Saturn are said to be red hot or at any rate boiling hot for a different reason, because they are supposed never to have cooled from a primitive molten condition. Through underrating the power of the sun's rays, Mars was decided to be too far away from the sun and too cold to support life. The Moon was held to be a dead world, etc. Everywhere was witnessed the inability of science to appreciate the Lord's beneficence, foresight, and provision for every eventuality.

But Swedenborg opened new sources and brought a new day. "Swedenborg's philosophy begins by calling upon the name of the Lord; and by placing God at the center, it illuminates the remotest recesses of the created universe with a flood of light."

It seems to have been the commonly accepted view, that there is an opposition and divergence between science and religion. On the contrary I maintain that science and religion will be found to be in essential harmony and will mutually assist one another whenever their true relations are perceived, and when a basis is laid for their mutual understanding through the reception of a philosophic view which is wide enough to embrace them both in one universal law.

Science, today, signifies much more than a collection of observed facts about nature. Such facts form a necessary basis for natural science, but nowadays we ask for much more than this. We require to be shown the *meaning* of these facts, and seek by the aid of reason to develop a philosophic conception of nature. This philosophic conception is the real science, and the name, as now used, implies that we have such a conception.

Now a philosophy, to be anything like complete, must in-

clude and harmonize known facts of many sorts. If, owing to prejudice, the would-be investigator rejects a considerable part of the evidence, a very one-sided and imperfect explanation will result. Most certainly the evidence will not be all of one sort. As Professor William James put the matter, we may well ask: "Why, after all, may not the world be so complex as to consist of many interpenetrating spheres of reality, which we can thus approach in alternation by using different attitudes, just as mathematicians handle the same numerical and spatial facts by geometry, by analytical geometry, by algebra, by the calculus, or by quaternions, and each time come out right? On this view religion and science, each verified in its own way from hour to hour and from life to life, would be co-eternal."*

But a much closer rapprochement than that of the recognition of diverse interpenetrating but separate spheres of reality will come into view, if we grasp the possibility (which is neither more nor less than actuality) that these diverse spheres are indissolubly interconnected and are necessary for each other's existence. There arises then the enlarged conception of a universe made up of many parts, all under the dominion of universal law. It will then be seen that a natural science is not only incomplete, but is to a large extent illusory, unless it is supplemented by a spiritual science which deals with facts of another category than those of nature. The connection between these two realms of knowledge was made known to us by that master mind—that most profound thinker of the ages—Emanuel Swedenborg, in his doctrine of "discrete degrees," the most potent instrument for the reconciliation of "science" and "religion" that has ever been put forth, but which remains still strangely neglected.

Natural science had, indeed, and with reason, long been shy

* "The Varieties of Religious Experience," pp. 122-3.

of any rapprochement with a religious belief which founds its dogmas upon hypotheses and speculations concerning a life after death, and which often ignores what may be known from experience in the natural world.

In the eighteenth century there arose such thinkers as Thomas Paine and Benjamin Franklin in America, and Voltaire in France, challenging the prevalent dogmatic religious beliefs and asserting the right of freedom of thought in every domain of knowledge, whether relating to science, government, religion, or any other department. Shortly before, and to a certain extent contemporaneously with these "free" thinkers, Emanuel Swedenborg—to whom Emerson assigns "a place, vacant for some ages, among the lawgivers of mankind"—appeared and announced the consummation of the Last Judgment in the intermediate "World of Spirits" in the year 1757, and the opening of a New Era for the world through the removal of the clouds of infesting spirits of falsity, which being dissipated by the Judgment, a restoration of true freedom to man by the Lord Jesus Christ through the revelation of New Truth from His opened Word, was given at the same time and constitutes His "Second Coming." There is to be no other. All that has taken place in the world since that day serves to confirm the truth of this remarkable assertion.

In order that mankind should no longer be led astray by grievous errors, and that the minds of men might be enlightened by genuine knowledge of the life after death in the spiritual world, it was necessary that actual experience of that life should be granted to a man of this earth. Swedenborg, one of the foremost scientists of his day, was chosen for this mission. In order that the gap between science and religion might be forever closed, the command—"Come up hither, and I will show thee the things that shall be hereafter"—was given not to some monastic recluse, meditating on musty volumes of

forgotten lore, but to a man of the world, foremost in science and practical affairs, many sided, renowned as metallurgist, astronomer, anatomist, engineer, and inventor—constructor of the first ship-railway, the first mercury airpump, and other meritorious inventions—as statesman, the peer of any in the realm;—to this man of science was given the commission to spread abroad the New Gospel that the Lord Jesus Christ has come to reign, that His Kingdom is to be established in the hearts of men.

We have defined science. Let us hear Swedenborg's definition of religion: "*All religion*," he tells us, "is of the life, and the life of religion is to do good." It is genuine love of the neighbor. *Life*, and the *good* life, is emphasized. Nothing is said about belief (that much abused word), although, of course, he recognizes that we cannot know what things *are* good without a true doctrine. But truths are many. No mind can comprehend them all. It is permitted that diverse minds shall envisage truths in many different ways; yet all seekers after truth, without asking for complete unanimity of opinions, can be united in mutual love by a common bond of charity; for while truths are many, the good of love is single and unites all into a whole—*e pluribus unum*.

Spiritual science needs to be added to natural science, in order that the conjunction of the two may give rise to a valid philosophy. Heretofore it has been difficult for one who presents this view among scientists to obtain a hearing. He may be listened to respectfully but with scant conviction. The prevalent view among men of science is that these are speculations without any basis of facts, and this because most scientific people have imbibed a prejudice against those who present the spiritual and religious aspects of thought. Science founds all of its beliefs on the facts of experience. But most religious systems have heretofore presented dogmatic assertions in the

place of experience. The New Church alone has a religious doctrine which rests upon *things heard and seen*, and which relegates to oblivion whole libraries of speculation concerning the life after death and the spiritual nature of man. People are slow to realize the wonderful difference which this makes in our reception of eternal life as a reality and its bearing on things mundane.

The chief essential of intellectual freedom is the keeping of an open mind. The faculty of judgment in intellectual matters must be preserved like a delicately poised magnetic needle, free to turn at the least impulsion of the magnetic currents, ever constant to the pole of truth. "Just balances, just weights, a just ephah and a just hin shall ye have." (Levit. xix, 36.) A just balance—an honest opinion—will not seek to distort judgment by base insinuations or baseless accusations. On the other hand, intellectual freedom does not forbid "nailing a lie" and "calling a spade a spade," on due evidence.

In looking for a better understanding between science and religion, we ask for no unholy alliance, no hybrid monstrosity, half woman and half fish—the spiritual affection of truth becoming degraded to the level of sensual apprehension and immersed in the sea of natural knowledge. A discrete degree separates the two. But the living things of that sea (the scientifics of nature and our affection for them) are to be drawn out and humanized by being elevated to higher uses. The Lord, walking by our seashore, will give us heavenly food and will show us "a fire of coals there, and fish laid thereon, and bread." (John xxi, 9.) These things can only be understood by opening the door of a spiritual understanding of the Word.

Science has been asking for facts about the spiritual realm, equal in value to those which it now has about nature. In what way could such facts be given, save in the sublimation of sense-experience and the opening of the spiritual senses?

It is given to some of us who are still in bodies of flesh to have our spiritual eyes opened, not to the extent that they were opened in Swedenborg's case, but still sufficiently to demonstrate the existence of spiritual senses. It is the eye of the spirit which sees in any case. The eye of flesh is nothing but a sort of photographic camera for taking a succession of instantaneous pictures, each one wiped out as fast as it made, but not before it is, or may be viewed by the eye of the spirit and its contents noted.

The complete unification of natural and spiritual truth is made known to us through the revelation of the hidden things of the Word of God, and this unity will become more evident as men enter more deeply into the heavenly arcana; but already inklings of the truth and indirect confirmations of the immediate connection between the spiritual and the natural worlds have been received by natural science which, though it cannot discover spiritual truth by its own unaided power, can confirm it.

Consider only a few of the remarkable advances in natural science which confirm Swedenborg's philosophy in its essentials. The world, as yet, little realizes the treasures which it possesses in these epochal disclosures. As a man of science Swedenborg was at least two hundred years ahead of his age. Before him, and long after him, the atoms were regarded as solid, unbreakable, structureless particles. He first taught that the elementary particles are woven by vortical motion out of perpetually inflowing energy in trinal structures and in successive order.

Two of these structures, namely, the atom and the electron, are now known. The third, or inmost, primal particle has not yet been isolated, but its existence is assured; and the intricate, never-ceasing internal motions at enormous speed within the atoms are demonstrated by spectroscopic evidence. Lord

Kelvin's "vortex-atom" had to be abandoned for cause, but Swedenborg's will live.

It was the Roman poet-philosopher, Lucretius, who conceived that the universe is continuously formed and reformed by the play of atoms whose motions never cease. Though objects may appear to be at rest—do not be deceived!—these are but phantoms. Within are countless whirling atoms whose intricate mazes weave the form to which we attribute permanence.

But Lucretius took his atom from Democritus and Epicurus and, with them, conceived it to be a structureless, solid, least particle of "matter," without inquiring further as to its nature or origin. The idea continued to prevail until a very recent date.

The French philosopher Des Cartes, the originator of the "Cartesian" co-ordinates which are the foundation of analytical geometry, taught that the primitive solid was not unbreakable, but that through fracture and the attrition of innumerable impacts, particles of more than one sort have been produced, some rounded like wave-worn beach pebbles, some angular like shattered fragments of a volcanic breccia. But none of these particles were conceived to possess any *internal* structure, nor was the question asked: How did the atoms, or primitive particles originate?

Chemists, down to the end of the Nineteenth Century, with only a few exceptions, had spoken of the atoms as if they were eternal, and as to *structure* in atoms, nobody breathed of such a thing. Yet, almost two centuries before, there had been given an elaborate theory of "elementary particles" structured by motion and formed, not "out of nothing," as the scholastics would have it, but out of *energy* which in its inmost essence was conceived as something spiritual. For the first time an adequate scheme of the derivation of material structure had

been produced. Lucretius had supplied the thought of phantasmagoric forms given by motion, but his motions were those of a single order of undifferentiated particles. And Newton knew no better. His "primitive Particles" are "solid, massy, hard, impenetrable . . . so very hard as never to wear or break in pieces." How incomparably superior is Swedenborg's conception of successive orders of vortical motion in a series of atmospheres inmosty produced by emanation through discrete degrees from *spiritual substance* whose inmost is the Divine Love!

The Alsatian philosopher, Adolph Hirn, has pointed out that, of the real nature of energy, our senses give us no knowledge. We can compare it to nothing but the human will, whose existence is assured, but which can only be explained by a true doctrine of the spirit of man.

Professor Benjamin Pierce has said: "Motion appears to be the simplest manifestation of power, and the idea of force seems to be primitively derived from the conscious effort which is required to produce motion. Force may, then, be regarded as having a spiritual origin, and when it is imparted to the physical world, motion is its usual form of mechanical exhibition." (Proposition 2 of the treatise on "Analytical Mechanics.")

Swedenborg, in addition to a most painstaking search in the domain of the physical forces for the origin of matter (tracing it back at last to his "*conatus*," or energy) sought long through the mazes of anatomy for some evidence of the nature of the human soul. In addition to valuable treatises on the organs of the body considered as "The Soul's Kingdom" (*Regnum Animale*), he produced such notable works as "The Fiber"—on the primitive substance out of which the body is woven, which bears to gross anatomy the same relation that his theory of elementary particles bears to the physics of matter, the work on "The Generative Organs," and perhaps the greatest

of his scientific writings—that on “The Brain,” still only partially published, but which, though it has lain in manuscript on the shelves of the Royal Academy of Science at Stockholm for nearly two hundred years and might be imagined to be quite out of date by now, is still so far in advance of present-day achievement that it reads like an entirely novel work. Nevertheless, with all this searching, he failed to find *the soul*. But just at this point, when at the summit of his career as a man of science—chastened, however, by the recognition that the end in view, the finding of the soul, was as bafflingly remote as ever—there was given to the thoroughly prepared student the experience needed whereon to base a knowledge of the soul, *in the only way in which such knowledge can be given*, namely, by the opening of the spiritual senses and the revelation of the spiritual world. If students of science were to realize the epochal nature of the great event, they would leap for joy and would say with Nebuchadnezzar to the prophet Daniel: “Of a truth your God is the God of gods, and the Lord of kings, and a revealer of secrets, seeing thou hast been able to reveal this secret.” (Dan. ii, 47.)

But natural science, ignorant of the fact that there is a spiritual world, existing in a super-space of more than three dimensions, and that there are spiritual senses which can perceive that world as certainly—nay, far more certainly and clearly than our natural senses perceive the things of nature—hangs back and is unwilling to enter into these new realms of knowledge. Nevertheless, beginnings are being made and the march of discovery is forcing science to admit that “there are more things in heaven and earth than are dreamed of in [its] philosophy.”

In the New Christianity for March 13, 1890, I said: “The lower degrees of material substance are successively limited. In ascending, they throw off their outer coverings and expand

into fuller freedom and potency. A block of ice has but little power of motion. Transformed into water it has a greater activity. As steam it lifts great weights. Resolved into its chemical constituents, it becomes a dangerous explosive. Tear its atoms asunder, and gigantic solar maelstroms ensue at whose turmoil distant worlds may tremble. The grosser material substances change with the progress of time. Their underlying atoms seem more permanent; nevertheless, these also have a history and have passed through an exceedingly prolonged series of changes, slowly moving onward to a final dissipation."

Swedenborg's conception of an evolution of matter by influx of energy and successive compoundings of motion, is confirmed by all of the great discoveries of the present time in respect to electrons and the electric composition of matter. His assertion that within the elementary particles there are intricate revolutions of still finer particles, performed with enormous velocity, is fully confirmed by the discoveries of spectroscopic science in regard to the Zeeman effect. His assertion that the least particles of iron are magnets from this internal revolution and that magnetization consists in making them all turn one way, was long since rendered probable by Ampère's discoveries, and is now completely demonstrated by the fact that there are the aforesaid electronic circulations within the atoms. There remain some puzzling questions—why some atoms are magnetic and others not; but these will yield to further investigation. The broad general facts are assured.

As to the supposed evidence in regard to telepathy and communications from discarnate spirits which our societies for psychical research are producing, nothing has been made known which was not already on record in Swedenborg's experiences. In fact, as Professor Hyslop has said: "Swedenborg was the first psychical researcher." But as he warned us and as the

modern researchers are beginning to find out, much of this evidence is of doubtful value, because of the great facilities for deception on the part of evilly inclined discarnate spirits. Swedenborg was especially permitted and commissioned to make these things known to us, and he was divinely guarded against infestation by evil spirits. Those who insist on getting first-hand knowledge in spite of warnings that they are likely to burn their fingers, and that such attempts are disorderly for spiritually minded men, should heed the advice of Sir William Barrett in his work, "On the Threshold of the Unseen," quoted on page 476.

The "Prophet of the North," Emanuel Swedenborg, is the divinely appointed link between science and religion. In his God-given experience we have a thoroughly assured witness that there is both a natural and a spiritual universe, and that the two are one through their subservience to one universal law.

In addition to his philosophy of the little things in nature, we find in Swedenborg a philosophy of the greater universe:—the doctrine that planets were thrown off from the sun in its early stages; that the phenomenon of a "new star" is, at least in certain cases, nothing else than the birth of a new world by the rolling off of a dark solar incrustation and the separation of the resultant orb or orbs; that the great Galaxy of stars is magnetically controlled; that there are innumerable galaxies; that there are forms and series of diverse orders in creation; that the spiritual world is not in space, but in what we may call a *super* space, or space of more than three dimensions; that the human brain pulsates according to the breathing; that the spirit draws in the spiritual atmospheres of thought and affection, while the lungs draw in air; that each of the cells of the brain-cortex (which are as many as the stars in the galaxies of heaven, arranged like them, in a stupendous order, and which are the immediate instruments of the soul) is a miniature

brain, spirally woven out of the simple fiber; that the spirit of man is in the human form and has spiritual senses corresponding to those of the body, but more wonderful and potent; that death is only the withdrawal of this spiritual organism from its material sheath.

He taught that sustentation is perpetual creation by Divine Influx and that creation takes place by means of *two* suns, the Sun of the spiritual world and the sun of nature. The latter is fiery and dead.

"Nature is also dead, because it derives its origin from that sun; . . . but the Sun of the spiritual world is alive." This spiritual Sun is not God but is "the First Proceeding of the Lord about Him from Him." The Lord is sometimes seen by the angels as a Divine Human form standing in their Sun. They need no light of nature's sun, "for the Lord God giveth them light." (Rev. xxii, 5.) The heat and light of heaven are love and wisdom. The Divine Love is veritable spiritual substance and the *only* substance, and Divine Wisdom is its form. . . . In all created things there are three discrete degrees, just as in every work of man the plan and the means for its execution exist simultaneously in complete union in the thing itself. A heaven of angels is the final end of creation. Through living *correspondence*, all things in the natural world are connected with their counterparts in the spiritual world and draw their sustenance therefrom. The Word of God embodies Divine Truth in *correspondences* and thus unites Heaven and earth. The entire Angelic Heaven, wherein reside the spirits from the innumerable earths in the Universe, is in the sight of the Lord as one man—THE GREATEST MAN—and human society on earth is to become similarly unified and harmonized as an organic form. The establishment of this organic unity of the race is the supreme purpose of the Lord in His Second Coming as "Son of Man."

This philosophy satisfies me as no other does. In my opinion it will surely live. Moreover, I hold that the highest and holiest doctrine, taught by Swedenborg—that of the Lord, of His Incarnation and Second Coming—solves the problem of the ages and is needed now, as never before, for the enlightenment and salvation of a war-racked world.

“The men of Nineveh shall stand up in the Judgment with this generation, and shall condemn it; for they repented at the preaching of Jonah, and behold, a greater than Jonah is here.” (Luke xi, 32.)

“The Second Advent of the Lord takes place by means of a man, before whom He has manifested Himself in person, and whom He has filled with His Spirit, to teach the doctrines of the New Church through the Word from Himself.” (Swedenborg’s *True Christian Religion*, n. 779.) Because many scientists still maintain that there is a necessary warfare between science and religion, I have endeavored to show how they may be reconciled.

Faculties are given to man by which he may discover things for himself, but these things concerning life in both worlds could not be found by man unaided; therefore, it pleased the Lord to reveal them, because the time had come when it was not well that man should remain in such gross ignorance any longer.

There remains an abundance of things which can be found out by observation, by which men can supplement and confirm the new knowledge, if they will.

It is to be known that the supreme end or purpose of the Lord is the formation of a Heaven of Angels to whom He can give eternal life and happiness; and to serve as a basis, planets are needed which can be formed into worlds on which life can exist. To complete the revelation something had to be known about the inhabitants of the other planets.

That all things that are real have existed and do exist by the Divine Truth which is from the Lord, and thus by the Word, is an arcanum which has not yet been disclosed. It is believed that by this is meant that all things have been created by God's saying and commanding, as a king in his kingdom. It is not this, however, that is meant by all things having been made and created by the Word, but it is the Divine Truth which proceeds from the Divine Good, that is, proceeds from the Lord, by which all things come into being and exist. (*Arcana*, n. 5272²).

All things have been created from substance which is substance in itself. Many have seen this, but feared that they would come to think that the created universe is God. . . . The reason is that they have thought of the creation of the universe from time and space, which are proper to nature; and no one can, from nature, perceive the creation of the universe; but everyone can, from God, perceive nature and its creation. . . . Although God created the universe from Himself, there is nothing in the created universe which is God. (*Divine Love and Wisdom*, n. 283.)

*The Angelic Idea concerning the Creation of the Universe
from the Lord*

The angelic idea concerning the universe created from the Lord is as follows: That God is the center, and that He is a Man, and that, unless God was a Man, creation would not have been possible, and that the Lord from eternity is that God. Concerning creation they said, that the Lord from Eternity, or God, by His Divine Proceeding, created the universe and all things therein, and since the Divine Proceeding is also life itself, that all things were created from life and through life; and that the proximate Divine Proceeding is what appears before the angels as a sun; that this sun before their eyes appears fiery and flaming; and that the Divine Proceeding is Divine Love and Divine Wisdom, of which such is the appearance afar off. They added that the Divine Proceeding is what the ancients effigied by golden or lucid pure circles around the head of God, and which modern painters still retain from the ancient idea. They said that from that sun, as a great center, proceed circles, one after another, and one from another, even to the ultimate, where their end is, subsisting in rest; and that those circles of which

one is from another, and one after another, appearing as extended into what is broad and into what is long, are spiritual atmospheres, which the light and heat from their sun fill, and by which they propagate themselves to the ultimate circle, and that, in the last, by means of those atmospheres, and afterwards by means of the natural atmospheres which are from the sun of the world, was effected the creation of the earth, and on it of all things which are for use, which creation is afterwards continued by generations from seeds, in wombs, or in eggs. Those angels who knew that the universe so created was a continuous work from the Creator even to the ultimates, and that, as being a continuous work, it, as one concatenated whole, depended upon, was actuated and governed by, the Lord, who is its common center, said, that the first proceeding was continued even to the ultimates by discrete degrees, altogether as an end by causes into effects; or as something producing and its products in a continuous series, and that the continuation was not only in, but also around, from the first, thence from every prior into every posterior one, even to the postreme, and that thus the first, and from it the posterior, co-exist in their order in the postreme or last. From this continuity, as a one, they have an idea concerning the Lord, that He is all in all, that He is omnipotent, omnipresent, and omniscient, that He is infinite and eternal; and also an idea what the order is, according to which the Lord, by His Divine love and His Divine wisdom, arranges, provides, and governs all things.

It was asked, whence, then, is hell? They said, from the freedom of man, without which man would not be man; that man, from that freedom broke continuity in himself, which being broken, separation was effected, and the continuity, which from creation was in him, became as a chain, or a linked work, which falls to pieces through the breaking and plucking asunder of the links above, and afterwards hangs from small threads. Separation or breach was effected, and is effected by the denial of God. (Concluding paragraph of Swedenborg's posthumous work—"Concerning the Divine Wisdom.")

Swedenborg's own introduction to his "Earths in the Universe" should convince the reader that this is neither speculation nor fiction, but genuine knowledge. He says:

Inasmuch as by the Divine mercy of the Lord, things interior are open to me, which appertain to my spirit, and thereby it has been granted me to discourse not only with spirits and angels who are near our earth, but also with those who are near other earths,—and whereas I had a desire to know whether other earths exist, and of what sort they are, and what is the nature and quality of their inhabitants, therefore it has been granted me of the Lord to discourse and converse with spirits and angels who are from other earths, with some for a day, with some for a week, and with some for months; and to be instructed by them concerning the earths from which and near which they were; and concerning the lives, customs, and worship of the inhabitants thereof, with various other things worthy to be noted; and whereas in this manner it has been granted me to become acquainted with such things, it is permitted to describe them according to what has been heard and seen. It is to be observed, that all spirits and angels are from the human race; and that they are near their respective earths; and that they are acquainted with things on those earths; and that by them man may be instructed, if his interiors be so open as to enable them to speak and converse with them; for man in his essence is a spirit and together with spirits as to his interiors; wherefore he whose interiors are opened by the Lord, may discourse with them as man with man; which privilege has been granted me now for twelve years daily. (n. 1.)

Since the information thus obtained came from spirits, it deals mainly with the things of spiritual life and character, and not so much on physical surroundings; still these are occasionally described. Thus we are told that there are men on the moon and that on account of the extreme rarefaction of the lunar atmosphere a special apparatus is provided in their bodies in order to condense it, much as fishes replenish their air-bladders from the small amount of air dissolved in sea water. An amusing incident is described which illustrates the fact that spirits retain all of the characteristics which they have derived from their life in the body, even to those which were peculiar to the conditions into which they were born:

Certain spirits appeared over my head, and thence were heard voices like thunder, for the thunder of their voices exactly resembled the sound of thunder from the clouds after lightning. I at first conjectured that it was owing to a great multitude of spirits, who had the art of uttering voices attended by so loud a noise. The more simple spirits, who were with me, smiled on the occasion, at which I was much surprised; but the cause of their smiling was presently discovered to be this, that the spirits who thundered were not many but few, and were also as little as children; and that on former occasions they had terrified them by such noises, and yet were unable to do them any hurt. In order that I might know their nature and quality, some of them descended from on high where they were thundering, and what surprised me, one carried another on his back, and thus two of them approached me. Their faces appeared not unhandsome, but longer than the faces of other spirits; in regard to stature, they appeared like children of seven years old; but more robust; thus they were dwarfs. It was told me by the angels that they were from the Moon. He who was carried on the other's back, on coming to me, applied himself to my left side under the elbow, and thence discoursed with me, saying, that whenever they utter their voices, they thus thunder; and that thereby they terrify the spirits who are inclined to do them mischief, and put some to flight, and that thus they go with security whithersoever they are disposed. To convince me that the noise they make was of such a sort, he retired from me to some other spirits, but not entirely out of sight, and thundered in like manner. They showed moreover, that the voice being uttered from the abdomen, like an eructation, made this thundering sound. It was perceived that this was owing to this particular circumstance, that the inhabitants of the Moon do not speak from the lungs, like the inhabitants of other earths, but from the abdomen, and thus from a certain quantity of air there collected, by reason that the Moon is not encompassed with an atmosphere like that of other earths. (*Loc. cit.*, n. 111.)

The atmospheric deficiency on the Moon is now abundantly confirmed by astronomical observation, first, by the absence of twilight; second, by the sharpness of all shadows and especially by the hardness of the Moon's limb, projected against

the bright background of the sun in solar eclipses in their partial phases. There is no hazy margin, such as would be produced by an envelope, either of dust or of gas. Third, by the instantaneousness with which a star vanishes when occulted by the Moon.

The reason for this low density of the lunar atmosphere is believed to be because the gravitational attraction of the Moon is not great enough to retain the molecules of air whose speed (thermally produced) exceeds a certain velocity. Owing to the heat imparted by the sun's rays to the equatorial regions of the Moon, this speed is often exceeded. If the air were denser, or more absorbent, it would become still hotter and would experience still greater losses. Thus the heat of the atmosphere and its density are to some extent automatically controlled.

This leads us to a question which has been the subject of much controversy: What is the temperature of the Moon?

Professor Ferrel showed long ago from theory that, owing to the long duration of the lunar day, the heat from solar radiation where the sun is high, must accumulate until a very high temperature is reached. Lord Roose estimated the temperature of the Moon at the full at something like that of boiling water, but inasmuch as the probable error of his thermophile measures was very large, many refused to accept his result; and because the thin air of high mountain summits is very cold, they urged that the Moon must be a frozen body. My thermal maps of the Moon at all phases, obtained with the bolometer, were really the first adequate determination of the facts by direct observation. But these also for more than a generation were rejected, though unjustly, as I showed in my paper, "The Temperature Assigned by Langley to the Moon." (*Science*, N. S., Vol. xxxvii, p. 949, June 20, 1913.) Ferrel's argument is completely right. Just as the sun's rays at the

poles, though shining at very low angles, are able, after weeks of accumulation, to bring our short but relatively hot Arctic summer, so the sunshine on the Moon, after a week of continuous action and with inappreciable losses by convection to cooler regions, brings a temperature of 80° Centigrade above the boiling point of water over an equatorial zone 20° wide at points where the sun is shining within 10° of the zenith.*

Of course, the heat attained depends partly on the irradiated material. A surface of polished metal will reflect much solar radiation and will remain relatively cool; but using such materials as are liable to be found on the Moon, the variation with the material was not as great as perhaps might have been anticipated.

There are undoubtedly numerous hot springs on the Moon and the evaporation of the moisture must produce local cool spots. With almost no atmospheric convection it is possible for local surfaces of ice and of blisteringly hot sunlit rock to exist side by side. Such a case is seen in Linné, where the vapor of water issuing during the night and condensing, spreads a circle of hoar frost or possibly of snow around the vent, which progressively diminishes in diameter after sunrise, to be restored on the following night. Professor W. H. Pickering finds local spots which invariably darken or change color as the altitude of the sun changes, and which he interprets as areas of moisture or of vegetation.

In the paper cited (p. 286), I said: "A large part of the Moon experiences daily great vicissitudes of temperature. The rocky surface at midday, in latitudes where the sun is high, is probably hotter than boiling water; and only the most terrible of Earth's deserts, where the burning sands blister the skin, and men, beasts, and birds drop dead, can approach a noontide

* See F. W. Very, "The Probable Range of Temperature on the Moon," *Astrophysical Journal*, Vol. VIII, p. 284.

on the cloudless surface of our satellite. Only the extreme polar latitudes of the Moon can have an endurable temperature by day, to say nothing of the night, when we should have to become troglodites to preserve ourselves from such intense cold."

Although no measurable heat could be detected with my apparatus on the night side of the Moon, we cannot certainly say that the temperature descends to absolute zero in the night, since even a small amount of some specially absorbent vapor could keep a little heat in; but it is certain that the temperature falls very rapidly towards sundown and passes the frost line before sunset, except where local hot springs may give some protection. Possibly the fables of the elves and the gnomes, tiny people and cave-dwellers, may here be founded on fact.

Swedenborg informs us that the different peoples have various functions resembling those of the different organs of the body. None can be spared and all are associated in a "GRAND MAN." He says:

"I was instructed, that the spirits of the Moon, in the GRAND MAN, have relation to the ensiform cartilage or *xiphoides*, to which the ribs in front are joined, and from which descends the *fascia alba*, which is the *fulcrum* of the abdominal muscles."

The lunarians have but a feeble life. Their small stature and timidity indicate as much. Great activity requires abundant oxygen. This the Moon-men have not. Food also must be scarce there. If they live as many days as we do, that would mean thirty times as many years. Truly a very sluggish existence, well typified by these cartilages.

The small density of the lunar atmosphere may be shown in another way, namely by the smallness of its reflecting power. The brightness of a planet depends not so much on the nature of its solid surface, as it does on the amount of its atmosphere

and upon the extent of its cloudiness. Unless the solid surface is covered with snow or some equally brilliant reflecting substance, it contributes but little to the reflection. Air is a good reflector, especially of the shorter light-waves, as witness our brilliant blue skies; and clouds are even better reflectors. Clouds are practically unknown on the Moon. A light-colored deposit, which may be volcanic ash, is seen around certain craters. As for the rest, the rocky surface exhibits a great variety of shades and colors, best seen at the full, but few of them have notable brilliancy. What I call the geometrical albedo of the full moon for visible rays, or the average luminosity at a point, such as the pupil of the eye, is 0.150 from a mean of Zöllner's measures (corrected) and my own (the maximum possible being unity). Some prefer to use what is known as the "Bond" albedo, or the brightness of an indefinitely extended surface which perfectly and diffusively reflects the light of the full moon. This is compared with the total luminosity from the *entire* sphere of the sun, and is, therefore, one-half as large as the former, or 0.075, since the Moon shines by only a hemisphere.

What we should like to know is the spherical albedo of a planet, due to the light reflected in all directions. For the Moon this is easily obtained and is equal to 0.052; but for the other planets the spherical albedo can only be known approximately, because we cannot observe them in all parts of their orbits.

Mercury has a somewhat larger mass than the Moon and is able to retain more air in spite of its high temperature at the sub-solar point, due to its always turning the same face to the sun, a fact which was discovered by the Italian astronomer, Schiaparelli. Its geometrical albedo is 0.234, and its spherical albedo 0.082. Owing to the unusually large eccentricity of the orbit of Mercury, the orbital velocity varies through a wide

range; and as the rotation of the planet remains constant the sun changes its position with respect to the horizon, and also alternately rises and then reverses its motion and sets over wide gores of the surface, owing to this rocking of the libration, in a semi-diurnal period which is also a semi-annual period, since the day and the year coincide. On account of the libration it is not strictly correct to say that Mercury turns always the *same* face to the sun, because it exhibits much more than half its surface to the sun's rays.

A curious criss-cross of dark markings suggests that possibly the vapor of water distilled from the day side may condense to ice in the rarefied atmosphere of the night side, to be melted in the fluctuations of the complex meteorology of the librations, and gathered into the great circumferential channel, whence it emanates in streams which are lost in the desert sands, but not until they have essentially ameliorated the climate by their evaporation. The chief habitable region must be alongside of the great channel where the sun never rises very high and a mild temperature may prevail.

Two antipodal hemispheres divide the planet, the one of which frizzles under eternal sun, the other freezes amid everlasting night. The sun does not, indeed, stand stock-still in the sky, but nods like some huge pendulum to and fro along a parallel of latitude. In consequence of libration the two great domains of day and night are sundered by a strip of debatable ground $23\frac{1}{2}^{\circ}$ in breadth on either side, upon which the sun alternately rises and sets. Here there is a true day, eighty-eight of our days in length from one sunrise to the next. But its day and night are not apportioned alike. The eastern strip has its daylight briefer than its starlight hours, the western has them longer. Nor are different portions of the strip similarly situated in their sunward regard. Only the edge next perpetual day has anything approaching an equal distribution of sunlight and shade. The farther one just peeps at the sun for a moment every eighty-eight days, and then sinks back again into obscurity. (Lowell, "The Evolution of Worlds," pp. 70-71.)

This much concerning what may be known or surmised from natural science. Let us listen to what is given from the more reliable spiritual science:

I was desirous to know what kind of face and body the men in the earth Mercury had, whether they were like the men of our Earth; instantly there was presented before my eyes a woman exactly resembling the women in that earth. She had a beautiful face, but it was smaller than that of a woman of our Earth; her body also was more slender, but her height was equal; she wore on her head a linen cap, which was put on without art, but yet in a manner becoming. A man also was presented to view, who was more slender in body than the men of our Earth are. He was clad in a garment of a dark blue color, closely fitted to his body, without any foldings or protuberances. It was given to understand, that such was the form of the body, and such the dress of the men of that earth. Afterwards there was presented to view a species of their oxen and cows, which, indeed, did not differ much from those of our Earth, only that they were less, and in some degree approaching to a species of deer. (Earths in the Universe, n. 44.)

They were questioned, also, concerning the sun of the system, how it appears from their earth? They said, that it appears large, and larger there than when seen from other earths, and that they knew this from the ideas of other spirits concerning the sun. They said further, that they enjoy a middle temperature, neither too hot nor too cold; it was on this occasion given me to tell them, that it was so provided of the Lord in regard to them, that they should not be exposed to too much heat, by reason of their greater nearness to the sun, inasmuch as heat does not arise from the sun's nearness, but from the altitude and density of the atmosphere, as appears from the cold on high mountains even in hot climates; also that heat is varied according to the direct or oblique incidence of the sun's rays, as is plain from the seasons of winter and summer in every region. (*Ibid.*, n. 45.)

The larger part of what Swedenborg tells us about the inhabitants of the planets concerns their character and spiritual life. These are the things most worth knowing and most

intensely interesting. These are the knowledges that the spirits of Mercury roam through the universe to gather and store away in their memories.

Inasmuch as the spirits of Mercury in the GRAND MAN, have relation to the memory of things abstracted from what is material, therefore when anyone discourses with them concerning things terrestrial, corporeal, and merely worldly, they are altogether unwilling to hear him; and if they are forced to hear, they transmute the things spoken of into other things, and for the most part into things contrary, that they may avoid attending to them. (*Ibid.*, n. 31.)

That I might be fully convinced of this their particular genius and character, it was allowed to represent to them meadows, fallow lands, gardens, woods, and rivers, (to represent such things is imaginatively to exhibit them before another, in which case, in another world, they appear to the life) but they instantly transmuted them, obscuring the meadows and fallow fields, and by representations filling them with snakes; the rivers they made black, so that the water no longer appeared limpid. When I asked them why they did so, they said that they had no inclination to think of such things, but of things real, which are the knowledges of things abstracted from what is terrestrial, especially of such things as exist in the heavens. (*Ibid.*, n. 32.)

Nevertheless they permitted Swedenborg to exhibit birds of various kinds, "because birds signify the knowledge of things, and the perception of this signification flowed in also at that instant; thus they desisted from transmuting them, and thereby from averting the ideas of their memory. Afterwards it was allowed to represent before them a most pleasant garden full of lamps and lights; instantly they paused and their attention was fixed, by reason that lamps with lights signify truths which are lucid by virtue of good. Hence it was made manifest that their attention might be fixed in viewing things material, if the signification of those things in a spiritual sense was but insinuated at the same time." (*Ibid.*, n. 33.)

It is their constant custom not to declare to another what they know, but still they desire to learn from all others what is known to them; nevertheless, with their own society they communicate all things, insomuch that what one knows all know, and what all know each one knows in that society. (*Ibid.*, n. 36.)

In consequence of their knowledges, the spirits of Mercury have an extraordinary degree of haughtiness; wherefore they are given to understand, that although they know innumerable things yet there are infinite things which they do not know; and that if their knowledges should increase to eternity, the notice of all general or common things would still be unattainable; they are told likewise of their haughtiness and high-mindedness, and how unbecoming such a temper is; but on such occasions they reply, that it is not haughtiness, but only a glorying by reason of the faculty of their memory; thus they have the art of exculpating themselves and excusing their foibles. (*Ibid.*, n. 16.)

Since every one must perform some use, it is evident that, when it is necessary, the Mercurials have to divulge what they know; and we may say that their office is that of news-gatherers, but not that of judging. During their life on earth it is permitted to some of them to speak with spirits. They do not know what innocence is, but all knowledges seem permissible to them. Thus they are not spirits of the highest order; still they are not evil.

The planet Venus was at one time thought to have a day very similar in length to our own; and this because, as in the case of Mercury, both bodies were observed at about the same hour in the evening and what were apparently the same markings were seen in the same position night after night. Similar 24-hour rotations were assumed to have restored the same presentation; but when Schiaparelli began observing Mercury at noon, there were the markings the same as in the evening or morning. The only changes were those due to the libration and these completely confirmed the slowness of the rotation.

Venus was more difficult to deal with, because the only

markings are exceedingly faint and hard to see. Finally Dr. V. M. Slipher with the spectroscope of the Lowell Observatory demonstrated that the rotation as given by the velocity in the line of sight at the limb, agreed with the supposition that rotation and revolution are, if not identical, at any rate very similar. The orbit of Venus is nearly circular. Libration consequently is not involved. The atmosphere is very nearly as dense as ours. Hence Dr. Lowell drew the conclusion that a perpetual whirlwind of hot air must rise over the center of the sunward hemisphere, powerful enough to raise great clouds of dust miles above the sunbaked surface, and that the return circulation left the frigid night side clad in glittering ice. Though there may be a partial truth in the hypothesis, the thermal measures of Petit and Nicholson at the Mt. Wilson Observatory are fatal to the doctrine of an arctic night side. Most unexpectedly the night side is found to be *warm*! Evidently convection is powerful enough to perpetually replenish the night side with horizontal currents of air, cooled, of course, by radiation to space, but still warm enough to keep the dark hemisphere from freezing.

Here is what Swedenborg says: "In the planet Venus there are two kinds of men, of tempers and dispositions opposite to each other; the first mild and humane, the second savage and almost brutal; they who are mild and humane appear on the further side of the earth [that is on the further side of the earth Venus, nearest the sun], they who are savage and almost brutal appear on the side looking this way. But it is to be observed, that they appear thus according to the states of their life, for in the spiritual world the state of life determines every appearance of space and of distance." (E. U., n. 106.)

This is written concerning appearances in the spiritual world, where a spiritual law determines that opposition of character shall produce a like opposition of spatial or *super-*

spatial situations. But may we not infer that a correspondential separation has taken effect in the natural world, and that by a spiritual attraction the vicious inhabitants of Venus "gravitate" toward that Earth which is the abode of evil, and thus are found on the side of Venus "looking this way"? If this is so, or *since* it is so, Swedenborg's words, though in slightly cryptic language, form really the first announcement of a modern scientific doctrine.

Continuing, we read:

Some of those who appear on the further side of the planet, and who are mild and humane, came to me, and were presented visibly above my head, and discoursed with me on various subjects; amongst other particulars they said, that during their abode in the world, and more so since they were become spirits, they acknowledged our Lord [that is, the Lord Jesus Christ] as their only God; they added, that on their earth they had seen Him, and they represented also how they had seen Him. These spirits in the GRAND MAN have relation to the MEMORY OF THINGS MATERIAL AGREEING WITH THE MEMORY OF THINGS IMMATERIAL, to which the spirits of Mercury have relation; wherefore the spirits of Mercury have the fullest agreement with the spirits of Venus, and on this account, when they were together, a remarkable change, and a powerful operation in my brain, was perceivable from their influx. (*Ibid.*, n. 107.)

I did not, however, discourse with those spirits who are on the side that looks this way, and who are savage and almost brutal, but I was informed by the angels concerning their nature and quality, and whence it comes that they are so brutal; the cause is this, that they are exceedingly delighted with rapine, and more especially with eating their booty; the delight thence arising, when they think about eating their booty, was communicated to me, and was perceived to be most extraordinary. That on this Earth there have been inhabitants of a like brutal nature, appears from the histories of various nations; also from the inhabitants of the land of Canaan, 1 Sam. xxx, 16; and likewise from the Jewish and Israelitish nation, even in the time of David, in that they made yearly excursions, and plundered the gentiles, and rejoiced in feasting on the spoils. I was informed further,

that those inhabitants are for the most part giants, and that the men of our earth reach only to their navels; also that they are stupid, making no inquiries concerning heaven or eternal life, but immersed solely in earthly cares and the care of their cattle. (*Ibid.*, n. 108.)

From the last statement we must infer that they at least make some incursions upon the day side to procure food for their cattle.

We are further informed that

in consequence of this their nature and quality, when they come into another life, they are exceedingly infested there by evils and false persuasions. The hells, which appertain to them, appear near their earth, and have no communication with the hells of the wicked of our Earth, by reason of their different tempers and dispositions; hence also their evils and false persuasions are totally of a different sort. Such, however, amongst them, as are in the capacity of being saved, are in places of vastation, and are there reduced to the last state of desperation; for there is no other method whereby evils and false persuasions of that kind can be subdued and removed. (Nn. 109, 110.)

Müller at Potsdam obtained for the albedo of Venus, 0.92, concerning which Dr. Lowell has said: "So high a value has seemed to many astronomers impossible, because so far surpassing that which has tacitly been taken as the *ne plus ultra* of planetary brightness, that of cloud, 0.72." But neither the albedo of cloud, nor that of Venus, is known with anything like this degree of precision; and by substituting Lowell's more accurate values of the diameters of the planets in place of Müller's, I have recomputed Müller's albedoes, obtaining for Venus, maximum geometrical albedo = 0.864 (spherical = 0.605), minimum values = 0.773 for the former (spherical = 0.580).

Whether Lowell's explanation of a cloud of dust, blurring the surface markings, is valid, or whether the brilliant veil must be attributed to high-level cirrus cloud is not certain.

I know of no reliable measures of the albedo of either dust or upper cirrus. The fact that the spectroscope has hitherto failed to reveal any water vapor in the atmosphere of Venus is offset by its similar failure to show any oxygen. Yet it is certain that Venus has an atmosphere quite comparable in density to that of our Earth. On the occasion of the last transit of Venus as observed at Allegheny, two brilliant luminous horns were seen to jut out from the edge of the sun upon contact with the planet and, as observed by Langley and Brashear who had telescopes of highest power, these horns lengthened as the planet advanced until they formed a completely encircling ring. Here there could be no question of reflection of sunlight by clouds. The sun shone from behind and its light was refracted by the planet's atmosphere and also diffracted by floating dust or ice-crystals, which, as flotation of fine particles demands considerable atmospheric density, testifies to that density, whether the action is one of refraction or of diffraction. An attempt which I made to get the spectrum of that atmosphere failed on account of rapidly forming terrestrial clouds. The observation seems to be one of difficulty but should not on that account obscure the fact that Venus has an atmosphere. Certainly also that atmosphere reflects a great deal of light and to that extent shields its sunward surface from the overpowering effect of a perpetual day. As to the night side, it may be of interest to note that as seen from Venus at the time of inferior conjunction, the full moon is of -1.98 magnitude, or about as bright as Jupiter at opposition, and the full earth shines as a star of -6.55 magnitude, by far the brightest star in the sky; so that the closely juxtaposed Earth and Moon would resemble a binary variable star of short period and great magnificence.

Of the spirits of Mars we are told, that they "are amongst the best of all spirits, being for the most part celestial men,

not unlike those who were of the most ancient church on this Earth." (E. U., n. 85.)

Spirits came thence to me, and applied themselves to my left temple, where they breathed upon me with their discourse, but I did not understand it; as to its flow, it was soft beyond what I had ever before perceived, being like the softest breeze; it breathed first upon the left temple and upon the upper part of the left ear; and the breathing proceeded thence to the left eye and by degrees to the right, and flowed down afterwards, especially from the left eye, to the lips; and when it was at the lips, it entered through the mouth, and by a way within the mouth, and thus through the eustachian tube into the brain when the breathing arrived thither, then I understood their speech, and it was given to discourse with them; I observed whilst they were speaking with me, that my lips were put in motion, and also my tongue in a slight degree, and this by reason of the correspondence of interior speech with the exterior; exterior speech is that of articulate sound conveyed to the external membrane of the ear, and thence to the brain by means of the small organs, membranes, and fibers, which are within the ear. Hence it was given to know, that the speech of the inhabitants of Mars was different from that of the inhabitants of our Earth, in that it was not sonorous, but almost tacit, insinuating itself into the interior hearing and sight by a shorter way; and, consequently, that it was more perfect, fuller of ideas, and thereby approaching nearer to the speech of spirits and angels. The essential affection also of the speech is represented amongst them in the face, and the thought thereof in the eyes; for the thought and the speech, and likewise the affection and the face, with them act in unity; they account it wicked to think one thing and speak another, and to will or desire one thing whilst the features of the face express the contrary; they are altogether unacquainted with hypocrisy, and likewise with fraudulent pretext and deceit. That the same kind of speech prevailed amongst the most ancient people on our Earth was given me to know by conversation with some of them in another life. (E. U., n. 87.)

I was instructed that the spirits of Mars, in the GRAND MAN, have relation to the middle principle between the intellectual

and the will-principle, consequently that they have relation to THOUGHT GROUNDED IN AFFECTION, and the best of them to the AFFECTION OF THOUGHT; hence it is that their faces act in unity with their thoughts, nor can they in any case play the hypocrite. And inasmuch as this is their relation in the GRAND MAN, therefore the middle province, which is between the cerebrum and the cerebellum, corresponds to them; for where the cerebrum and the cerebellum are joined together as to spiritual operations with such persons the face acts in unity with the thoughts, so that the very affection of thought beams from the face. (E. U., n. 88.)

The angelic spirits discoursed with me concerning the life of the inhabitants on their earth, informing me that they are not under any form of government, but that they live arranged into greater and lesser societies, and that they are associated with each other according to their agreement in mind, which agreement they discover instantly by the face and speech, being seldom deceived in their judgment herein, and that then they are instantly united in friendship. (E. U., n. 90.)

There was presented before me an inhabitant of that earth; he was not indeed an inhabitant, but like one; his face resembled the faces of the inhabitants of our Earth, but the lower region of the face was black, not owing to his beard, for he had none, but to blackness instead of a beard; this blackness extended itself underneath the ears on both sides; the upper part of the face was yellowish, like the faces of the inhabitants of our Earth who are not perfectly fair.

They said moreover, that on that earth they feed on the fruits of trees, especially on a kind of round fruit which buds forth from the ground; and likewise on pulse; and that they are clothed with garments wrought from the fibrous bark of certain trees, which has such a consistence that it may be woven, and also stiffened by a kind of gum which they have amongst them. They related further, they are acquainted with the art of making fluid fires, whereby they have light during evening and night. (E. U., n. 93.)

The last item suggests that they may have oil wells and that they have engineering ability, which, indeed, we have inferred on other grounds, from the great system of irrigating canals,

discovered by Schiaparelli and most diligently observed and mapped by Lowell.

Only a few years ago, these things would have been rejected by most astronomers, because it was held that the solar constant of radiation was only two small calories per square centimeter per minute at the Earth's distance; and as Mars is so much farther away that it receives only 0.376 as much radiation for equal areas as the Earth does, it was calculated that the temperature must be much below the freezing point of water. Taking Stefan's formula for radiation, the mean temperature of Mars was calculated by Moulton as -33° Fahr. $+60^{\circ}$ F. being adopted for that of the Earth. The difference of over 90° F. in the average temperature would mean death to our neighbor planet, and consequently those who accepted the argument did not hesitate to say that there could be no life on Mars. The disappearance in summer of what had been imagined to be "the snowy poles of moonless Mars," was a difficulty; but science had already abandoned the adjective "moonless." Perhaps one more *unscientific* guess could dispense with the "snowy poles." And sure enough the guess was forthcoming, and solid carbon dioxide was gravely put forward as a substitute for snow, although the most cursory examination of the suggestion should have brought the recollection that solid CO_2 can only be obtained under heavy pressure which certainly does not exist on Mars.

We have seen in Chapter VII that wild guesses have been palmed off by spirit mediums as to life on Mars, but they are no wilder than some that have been put forth in the name of science in the attempt to prove that life does not exist there.

By some, Swedenborg is classed with spirit mediums. Really, they have nothing in common. He did make a few *scientific* guesses for which we must be charitable. As regards the affairs of the spirit world, he spoke with authority. As to

modern scientific guesses, these, too, need our charitable consideration.

In 1901, I made a recomputation of the solar constant (Weather Bureau, No. 254) from the results of the Mt. Whitney expedition, correcting Langley's water-pyrheliometer measures by comparison of that instrument with a mercury pyrliometer which I had had made and which gave somewhat higher readings. In his original Report, although Langley mentioned these comparisons, yet he did not use them, although they seem to me undeniably better than the uncorrected results. I also introduced a new method of dealing with the depletion of the sun's rays by atmospheric dust. This was the more necessary in these particular observations, because that summer on Mt. Whitney was phenomenally dry and dusty.

I had discovered that the sun does not radiate as one piece at one temperature, but that the extreme infra-red rays come from deeper layers of the sun which are hotter. Actinometric, as well as spectrobolometric measures of solar radiation had convinced me that a large amount of violet and ultra-violet radiation disappears except in very cold weather. The complete theory did not appear until my paper of August, 1912, "A Criterion of Accuracy in Measurements of Atmospheric Transmission of Solar Radiation," in the *Astrophysical Journal* for January, 1913. In the paper of 1901, I emphasized the fact, discovered by Abney and Festing, but which had been largely overlooked, that most of the infra-red absorption bands in the solar spectrum are due to water-vapor. Especially pronounced are the diffuse bands which appear only when the relative humidity is high. In addition to this, water-vapor, or products dependent on that substance, is responsible for a large depletion at the other end of the spectrum in the violet and ultra-violet. I have tried to give a fuller explanation of this complicated subject in my paper on "Solar Radiation" (*Ameri-*

can Journal of Science, December, 1913), and also in the paper, "On the Need of Adjustment of the Data of Terrestrial Meteorology and of Solar Radiation, a Best Value of the Solar Constant." (*Astrophysical Journal*, November, 1911, see especially pages 377 to 380.)

The value which I gave for the solar constant, 901, namely 3.127 sm. cal./sq. cm. min., was adopted by Lowell and used in connection with some results by Crova, as a basis for his determination of the mean surface temperature of Mars, namely $+48^{\circ}$ F. or $+9^{\circ}$ C. Lowell's paper (in *Proc. American Acad. of Sci.*, Vol. 42, pp. 651-667, March, 1907) was adversely criticized by Poynting in a paper to which I replied in the *Philosophical Magazine* for September, 1908 ("The Greenhouse Theory and Planetary Temperature") in an argument which has never been refuted.

The solar constant was raised to 4.01 by Knut Angström on the ground that absorption by atmospheric carbon dioxide required it; but I showed in my "Atmospheric Radiation" that the argument was inadmissible, and Angström himself afterwards recognized this from his own independent measures and withdrew his value. More recently Bigelow advocated the value 4.0; but in my paper, "On the Solar Constant" (*American Journal Science*, February, 1915) I showed that his argument was utterly fallacious.

In the *Astronomische Nachrichten*, Nr. 4819-20, November, 1915, I determined from measures of the Earth shine on the Moon, a value of the Earth's albedo. This was adversely criticized by Russell (*Astrophysical Journal*, April, 1916). This led me to revise and correct the entire subject of planetary albedoes which was in a state of almost hopeless confusion. The result of my studies is contained in a work on "Lunar and Terrestrial Albedoes" (*Occasional Scientific Papers of the Westwood Astrophysical Observatory*, Boston: The Four

Seas Company, 1917). In this I showed that Zöllner's photometric measures on the Moon were exceptionally good, but that he had become confused by fallacious reasoning in his reductions. I had founded my earlier results on his, assuming them to be reliable, and now had to revise both his figures and my own. Russell's criticisms were shown to be wholly inapplicable, being the result of a complete misunderstanding of statements which should have been perfectly plain. The Lommel-Seeliger law for spherical albedoes was found to be no better than an empirical one and in order that it may be used at all, a term which contains a factor, $\log_e \cot \alpha/4$, must be changed as to the factor to $\log_{10} \cot \alpha/4$, not on account of any error in the mathematics, but because it otherwise leads to results not even remotely agreeing with the facts, the mathematical argument being illusory.

With the value of the Earth's albedo thus obtained (geometrical albedo = 0.720, spherical = 0.504, or considering the uncertainties of the latter, the fraction $\frac{1}{2}$ is near enough) I returned to the investigation of the solar constant with the following result as communicated to the American Astronomical Society (*Publications*, Vol. 3, p. 232). "After many attempts, I have succeeded in making a horizontal solar hot-box which appears to approach maximum efficiency, and which generates from the combined radiation of sun and sky by the heat-trapping influence of the Earth's atmosphere and of the cover of the box, a temperature of 423° Abs. C., capable of producing from blackened copper a radiation of 0.0302 C.G.S. units out of a 50 per cent delivery of the sun's rays—this being all that can be allowed according to the measurement of the Earth's spherical albedo given in my first paper. Twice this quantity gives

3.62 gram calories per sq. cm. per min.

as a first approximation to the solar constant."

Increasing Lowell's figures to conform to this new value of the constant, we have $+19.5^{\circ}$ C. or a little over $+60^{\circ}$ F., or a mean temperature actually hotter than that of the Earth, notwithstanding the greater distance of Mars from the sun. The explanation of this fact is that Mars has no oceans, while the Earth has two and a half times as much water surface as there is land, and the evaporation of water produces a notable chilling of a very large part of the Earth's surface. In addition to this the Earth's spherical albedo (0.502) and that of Mars (0.144) show us that three and a half times as much of the visible radiation of the sun is rejected by the Earth as is lost from Mars. Thus the smaller amount of heat received from the sun's rays by Mars is better conserved.

A few years ago, Coblentz made thermal measures in the image of Mars with a delicate thermopile and deduced a temperature of -16° C.; but this gives us only the temperature of the efficient radiant layer of the atmosphere, whose altitude remains unknown. The surface temperature is not revealed by such measures, as I have shown in my paper, "The Radiant Properties of the Earth from the Standpoint of Atmospheric Thermodynamics" (*Occasional Scientific Papers of the Westwood Astrophysical Observatory*, No. 3) of which an abstract may be seen in *Publications of the American Astronomical Society*, Vol. 3, p. 232, from which I quote: "There is great ionization by the sun's ultra-violet rays at high levels in the atmosphere, whereby much solar radiation disappears. Absorbent substances are generated thereby, and through their absorbent action the heat of the isothermal layer is produced. . . . I have determined the increase of thermal energy stored in the isothermal layer and find that there has been approximate doubling of heat (2.11:1.00) by this protective mechanism of the atmosphere. . . . Bigelow reaches the same ratio in another way and finds that 'the isothermal region

radiates 2.11 times as much heat as does the convectional region'." "If any layer of the atmosphere deserves to be called 'the effective radiating layer,' it is the isothermal layer, [depth 60 to 80 km.] where convection being no longer potent, the heat obtained by absorption of the incoming solar rays must be radiated back to space, since it cannot accumulate indefinitely. There is no evidence whatever of Angström's effective radiant layer of the atmosphere at 3000 meters. On the other hand, the peculiarly potent radiation-function of the isothermal layer of the atmosphere has been repeatedly pointed out by me." (F. W. Very, "Transmission of Terrestrial Radiation," etc., *Am. J. Sci.*, June, 1916, p. 517.)

The air does not radiate directly to space, except in its external layers, and even then only by certain of its constituents. Throughout the greater part of its course, air radiation towards space proceeds but a little way before it is absorbed by other portions of the air, and then is reradiated, the thermal energy being passed on by a continual alternation of radiation and absorption which is much slower than the purely radiative process.

The Mt. Wilson observers have obtained thermal measures from the polar regions of Mars, giving temperatures much below the freezing point, from which they have inferred temperatures near absolute zero in the long polar night; but here again the measures relate to elevated layers of air and there is no evidence of such extremely low *surface* temperatures. The polar regions of Mars after the autumnal equinox are continually covered by cloud and remain so during the winter. About the spring equinox, the cloud suddenly clears away, sometimes with a few short and temporary fluctuations, and a dazzling white surface of snow (which has been deposited under the cloud) is revealed, covering a circle over 2000 miles in diameter (2900 miles for the southern cap, 2500 miles

for the northern, according to W. H. Pickering). As the spring advances, this snow cap progressively diminishes in area through melting, and the air above it must be a little above 32° F. and need not have been very much below 32° F. during the cloud-protected night. At any rate the snow-covered area does not descend to such low latitudes as with us, and thus we have a further confirmation of the fact that the climate of Mars is warmer than that of the Earth.

Having disposed of the fallacious arguments for a frigid Mars, and recognizing that the life of the land is of a higher type than that of the sea, we are prepared to admit that life may have advanced much farther on Mars than here and are ready for the remarkable story made known to us by Dr. Percival Lowell, which I shall give in his own words.

The last few years, beginning with Schiaparelli in 1877, and much extended since at Flagstaff, have shown:

a. The surface of the planet to be very curiously meshed by a fine network of lines and spots.

b. The better the planet has been seen, the more this singular mesh discloses itself. It is very much as if a veil were drawn over the whole surface of Mars.

c. The lines of the network are each wonderfully straight, as if they had been laid down with the utmost regularity.

d. They run into one another at definite points, sometimes as many as fourteen converging at one of the junctions.

e. Each is of the same width throughout, so far as we may observe.

f. They differ, however, as between themselves, some being much larger and more prominent than others.

g. Their average width is apparently from ten to fifteen miles, certainly not more, and of the finer sort running down to a mile or two.

h. At the places where they meet are small, round, dark spots, which have been called oases by the writer.

i. These oases are also of differing size.

j. The network has been found to extend not only over all the

reddish ochre parts of the disk, but across the blue green ones as well, no part of the planet being exempt from them.

k. They end by running into one or other of the polar caps.

l. Their look is geometrical to a degree, suggesting artificiality on its face.

m. Their appearance is singularly confirmed by their behavior.

n. During the winter season of the part of the planet in which they find themselves, they are of exceedingly tenuous proportions, only just visible with care.

o. As the polar cap begins to melt in the spring, lines are seen running out of it, deeper in tint and more imposing in size than elsewhere to be seen on the disk.

p. As time goes on, the lines that connect with them successively darken down the latitudes.

q. Until the darkening of the network crosses the equator into the planet's other hemisphere.

r. The arctic or antarctic canals, as the case may be, lighten at the same time, and gradually this lightening, too, follows the wave of darkening which preceded it down the disk in like manner.

s. Half a year after the phenomenon thus disclosed at one cap, a regular wave proceeds from the other cap down the disk in the opposite direction. Thus in every Martian year two waves of darkening effect the canal system alternating from one cap and then the other, this rhythmic oscillation in appearance being exactly timed to the planet's seasons.

t. The oases undergo a similar regular transformation. From the merest pinpoints they develop into quite sizable round spots, and then in due season fade out again to what they were before. (*Scientia*, Vol. VII, pp. 4-5, 1910).

The argument was examined by Professor Edward S. Morse in his "Mars and its Mystery," and considering for one thing merely the geometry of the markings, he concluded that among all conceivable arrangements of lines, whether in river systems, mountain ranges, earthquake cracks, or any others, the only ones which resemble those on Mars are artificial. The system is an artificial one and the artifice must be of *human*

origin, for no mere race of beavers, however industrious, could be credited with such planet-wide observation, planning, construction, foresight, and coöperation as would be needed in so vast a design. Moreover the men who could thus agree among themselves and coöperate in such world-wide works of beneficence, must surely be a peaceful, industrious, and right-minded people, agreeing well with Swedenborg's description.

To see whether such an engineering project as that supposed for Mars is possible, Mr. C. E. Rousden has made the following computation in his book, "The Riddle of Mars the Planet." (Longmans, Green and Co., 1914.) From collecting reservoirs at lowest points, water may be artificially pumped to distribution reservoirs on the heights, whence it is forced by static pressure through a net of pipes in the blue green areas. These are not seen; but the irrigated turf along the canals is visible when the water is flowing. Each canal (10 miles wide on the average) consists of 500 pipes (100 ft. apart) the diameter being 6 ft., flow 3 ft. per sec., pumping stations 1150 normal horse power, 140 miles apart on each line of pipe. There are about 500 canals and the total horse power will be 2,500,000,000, much under that in daily use on our Earth.

After numerous failures on the part of splendidly equipped expeditions from the Lick Observatory which did not succeed in detecting any evidence of the presence of aqueous vapor in the atmosphere of Mars, and which were confidently announced as having demonstrated that there was no measurable water-vapor there (although they proved nothing of the sort, because the measures were undertaken at a time when the Earth's atmosphere contained a superfluity of moisture which overwhelmed and obscured the relatively slight amount of water on Mars), definite quantitative measures of Martian vapor were at length secured by observers associated with the

Lowell Observatory. Yet so powerful is a long accepted error to obscure the truth, that Director Campbell had no difficulty in continuing the promulgation of his inconclusive and misleading results, misinformation which still survives in numerous textbooks published long after the truth was known.

At the time of the Campbell-Very debate concerning water on Mars, Nature published a brief paragraph in which Campbell was described as having settled the question as to possible water-vapor on Mars in the negative. A challenging of this decision, sent by me to the Editor, was refused publication. I am happy to say that a majority of American scientific journals, as well as those of France, Germany, and Italy, gave ample recognition of my work.

Some sixteen years after my announcement of quantitative measures of oxygen on Mars, the Mt. Wilson observers obtained tardy confirmation of the same, getting 15% for the oxygen on Mars, where I found 15 to 24%. The interpretation of these measures is necessarily a little indefinite, because we cannot be quite sure how far the light has penetrated the Martian atmosphere before reflection.

I will again quote from Dr. Lowell's account, this time from *Scientia*, Vol. XIX, pp. 22-66, 1916.

The two great factors in minimizing our superincumbent moisture and thus furthering investigation are desertism in place and winter in time. The site gave Dr. Slipher the first of these and he took pains to select the second. How important the latter is was exemplified by Professor Campbell's spectrograms taken at Mt. Whitney in summer, and an unfortunately wet summer at that, in which he could perceive no Martian effect.

Dr. Slipher's time was not only judiciously chosen but was favored of fate. That winter was an exceptionally dry one. Whereas 16 per cent of saturation is usually considered a desert dryness, the index on this occasion once descended to 6, thus approaching ideality. His spectrograms showed the effect. In

those taken when the air was only moderately dry the difference in α between the Mars and Moon spectra is but slight, while when the air was exceptionally dry, the difference is salient.

Dr. Slipher's spectrograms were subsequently measured for relative intensities of the lines by Professor Very of the Westwood Astrophysical Observatory with a special band-comparator which he invented for the purpose and the results are embodied in the "Lowell Observatory Bulletin," No. 36.

Five of these plates were measured and they, in Professor Very's words: "without a single exception, tell the same story. The little α band in the spectrum of Mars is in all cases more intense than in the spectrum of the Moon at the same altitude and by nearly the same amount, while great C , which is of undoubted solar origin, and not affected by telluric absorption, is practically identical in the two spectra." . . . Dividing α Mars/ α Moon by C Mars/ C Moon we get $C = 1.$, $\alpha = 1.216, 1.248, 1.155, 1.155, 1.344$ [from the five plates].

Reducing these figures to absolute units and taking the mean he found the little α band in Mars to be: 4.47 times as intense as in the Moon while the solar line C was 0.955 as strong.

Interpreted this indicated 1.75 times as much water in the form of vapor in the Martian air at the time, as then existed above Flagstaff in the atmosphere of the Earth. But it must be remembered that Flagstaff represents nearly desert air and was moreover exceptionally dry on that occasion. This means for Mars about 1/3 or 1/4 of the mean amount for the Earth.

The next step in the investigation was productive of more results. It had best be introduced by Professor Very's words:

"By means of improvements in the spectral band-comparator which was originally described in 'Lowell Observatory Bulletin,' No. 36, I am now able to measure the strength of bands in absolute units of intensity, and at the same time to reduce the probable errors very materially. This permits the measurement of difficult test objects. Accordingly, at the suggestion of Dr. Lowell, I have made measures of Plate Rm 3076, formerly rejected. Of this plate Dr. Slipher says: 'Mars' spectrum is somewhat weak, and as the film is slightly defective over the red end of the spectra, the plate will not be further considered.'

"The circumstances of the exposure of this plate would have been exceptionally favorable had not the impression of the

Martian spectrum been rather faint. The exposure for the spectrum of Mars was equally divided on either side of that of the lunar spectrum, and lasted for 115 minutes, namely, from 6^h 20^m to 7^h 10^m, and from 7^h 25^m to 8^h 30^m on the evening of February 14, 1908."

In consequence of his improved facilities he was able to measure in addition to little *a* big *B*. Now *B* is another terrestrial line due to oxygen—the great oxygen line in our air. *C* which he again took as his standard is caused by hydrogen in the sun. Whether it be appreciably affected by hydrogen in our upper air is not known but from these very measures it would seem not. In *a*, *B* and *C* we have, then, hydrogen, oxygen and water-vapor for comparison, inter se, a dramatic combination since hydrogen and oxygen combine to form water.

As the outcome, not only did water-vapor again disclose its presence on Mars but oxygen revealed itself there. Professor Very at first thought to evaluate the latter but the under-exposed condition of the plate proved to make this impossible, the intensification observed in *B* being mainly due to photographic imperfection.

In order to leave no stone on the subject unturned Dr. Slipher in the winter of 1914 repeated at my instigation his research. The results were singularly instructive, the more so that from the condition of the air not much was expected of them. For that winter far from being exceptionally dry was if anything wet. The best criterion of this was the little *a* band itself in the lunar spectrum which had been in January, 1908, 0.07 as great as *C* was now in February 6, 1914, 0.31 as great as *C* showing that there was over four times as much moisture in our air on the latter occasion.

The credentials to acceptance of these plates were made as nearly perfect as possible. Two of them were measured by Professor Very—numbered by Dr. Slipher II and III—. Flanking the Mars spectrum, one on either side, were spectra of the Moon taken before and after the Mars exposure as synchronous as possible.

The mean altitudes were:

Mars Plate II 76° 23'	Plate III 62° 56'
Moon Plate II 72° 36'	Plate III 60° 10'

From which it appears that for real equal values the intensification was in favor of the Moon. The lunar a should actually have been darker i. e. stronger than the Martian if Mars possessed no water-vapor in its air, because a lower altitude means a longer earthly air-path with consequent increase in moisture.

Each plate contained two sets of Moon-Mars-Moon spectra numbered a and b , so that there were four separate determinations in all: 2a, 2b, 3a, 3b. A new stain used by Dr. Slipher in sensitizing the plates extended the sensitiveness farther into the red—which should improve the accuracy of the measures. Lastly the greater altitude of Mars in 1914 than in 1908 and the consequent smaller intensity of B in the lunar, that is the Earth's spectrum, gave the new measures an advantage, as Very points out, over the former ones for the oxygen in Mars determination.

Very then says: "The position of the slit in the Martian image was varied. The slit was equatorial in 2b and 3a. It was over the Arctic region in 3b and along the polar diameter in 2a. The following are the observed ratios of Mars/Moon:

Plate 2a, $C=1.009$	$B=1.270$	$a=1.881$	} Polar
Plate 3b, 1.040	1.159	1.531	
Mean 1.025	1.215	1.706	
Plate 2b 1.000	1.300	1.185	} Equatorial
Plate 3a 0.989	1.214	1.128	
Mean 0.995	1.257	1.157	
Mean of all, $C=1.010$	$B=1.236$		

"On Plate 3b there is a brighter streak of continuous spectrum, corresponding to a region of melting snow or cloud,* which gives a larger intensification of little a than the associated dark streak, when these are measured separately. The diversity of intensification appertains to a exclusively. The separate measures for this plate, reduced to $C=1$, are:

* The image was made to run along the slit, and a very slight displacement was sufficient to cause the snow cap to invade the slit.

(Plate 3b)

Bright Streak

Dark Streak

$C=1$

$C=1$

$B=1.113$

$B=1.112$

$a=1.770$

$a=1.205$

"Here, while C and B have not varied by as much as 1%, little a has changed by nearly 50%, and this change is certainly Martian. In the mean of all observations it will be seen that C is of identical intensity in the spectra of the two bodies, while B is 24% stronger in the spectrum of Mars; and the intensification of the band of aqueous vapor varies between 88% and 13%, according to the region of Mars covered by the slit.

"The result confirms the supposition that the melting snow of the Martian Arctic regions are the sole source of aqueous vapor in the Martian air, and that the equatorial regions are excessively dry, which supports Dr. Lowell's irrigation hypothesis. It seems a little surprising, nevertheless, that no more moisture diffuses in the form of vapor into the warm air of the tropics."

Measures which gave an extra intensification of great B in the Martian spectrum of .15 to .24 where one extra terrestrial atmosphere gave .17, amounts which are quite similar and would indicate that the oxygen on Mars is not more than half as great as ours, since the light has passed twice through the atmosphere of Mars but only once through ours. Indeed, considering that much of the light reflected from Mars must have made an oblique passage over a longer path, perhaps one-third would be a better fraction. The small albedo of Mars says the same. Owing to the clearness of the air of Mars, which is what makes the surface markings so well seen, cloud and dust must be in small amount. The albedo of 0.26 of which perhaps 0.10 comes from the solid surface, does not speak for much reflection from either air or dust. The density of the air on which the sustaining of dust in flotation depends, should be much smaller than ours according to this argument.

If oxygen on Mars is half as great as here, since superficial gravity on Mars is 0.38 of that on the Earth, the amount

of air *per unit volume* at the surface of Mars (assuming that other constituents, nitrogen, argon, etc., are in the same proportion as oxygen) will be about $0.5 \times 0.38 = 0.19$, or if oxygen is one-third of ours this becomes $0.38/3 = 0.127$ (Earth = 1). Lowell says: "If the original mass of air on each planet was as its own mass, we should have for the ratio between the Earth and Mars, 9.3 of atmosphere on the former to one on the latter. This being distributed as their surfaces, which are in the proportion of 7919^2 to 4220^2 [ratio = $3.473 = 1$] must be divided by 3.5, giving 2.7 times as much air for the Earth" *per unit of surface*.

But it is not entirely safe to assume that a planet's atmosphere is proportional to its mass. For instance, the mass of Jupiter is 14.7 times that of Neptune, but the latter has a far more absorbent atmosphere, whose density is unknown.

Since the barometric pressure depends both on the amount of air per unit of surface and the strength of gravity, both of which are smaller on Mars, the boiling point of water must be lower there and this must facilitate the seasonal transfer of moisture from pole to pole by the atmospheric road. Only a portion of this periodic transfer can be made to minister to man's needs by devices for irrigation. Natural processes still control a large part of the planetary activities. Thus the great green areas of the *Maria* which show where the lowest regions are and where alone water can accumulate naturally, are the most conspicuous markings on the globe, well shown on Green's beautiful colored pictures. They change color and are rejuvenated in the springtime but turn brown in the autumn of the waning hemisphere.

Professor W. H. Pickering, in his "Report on Mars," No. 5, (Popular Astronomy, May, 1914) describes extensive temporary changes in Martian "geography," or *Areography*, which are presumably due to spring floods. He says: "The inter-

section of the [northern] boundary of the [southern] *Maria* with the meridian of 140° on Schiaparelli's chart lies in latitude -35° . On the other figures it is successively $+9^\circ$, -33° , -40° , -42° , and -48° . In Lau's chart (*A. N.* 4706) it is placed in latitude -40° . On March 13 the planet was examined with the central meridian at 118° and the seeing 8, but no trace of any southern *Maria* could be seen. It would seem that at that time the intersection must have advanced at least as far south as to latitude -60° . Clearly any future maps of Mars should be accompanied with the Martian date of the determination of each primary station."

It appears that in the autumn the vegetation begins to die or turn yellow near the equator, and as winter approaches it retreats nearer and nearer to the pole,—the exact reverse of what occurs upon our Earth. In *Bulletin* No. 12 of the *Lowell Observatory* it is shown that for the canals in the spring time vegetation advances from the pole to the equator, also the reverse of what happens upon the Earth. The high latitudes of Mars would therefore seem to support vegetation for a longer time than those near the equator, which also seems strange to us. On the other hand the northern polar marshes with the advance of spring retreat towards the pole, following the snow cap. The dark band surrounding the northern snow cap appears at about the end of February (Martian date), advances rapidly towards the equator for a terrestrial month, retreats as rapidly, and then in the form of a narrow dark line, save where interrupted by the marshes, retreats with the snow line.

As winter approaches, an almost continuous cloud forms over that pole which is to have its winter. "Little sunlight reaches the polar regions apparently during the few months preceding their long winter. No evidence of snow was seen near the south pole. But little cloud was visible elsewhere. The southern *maria* are still green, but are retreating southerly."

From this it appears that Mars, like the Earth, is apt to

have its "dreary" November, dark and cloudy, before the winter snows begin.

In the spring come the first visible evidences of extensive areas of liquid water, *blue* from reflection of the now cloudless Martian skies. Certain spots in what is probably the lowest part of Mars—the *syrtis major*—exhibit this blue coloration, being connected with the polar caps by either one or a pair of canals. Let us hear Professor W. H. Pickering on this point:

Although traces of blue are still to be seen in some of the four great polar marshes, yet they are now so remote, that no satisfactory evidence of polarization has been detected in the light reflected from their surfaces. This polarization has only been seen in the past for a few days at a time, and it probably requires a fairly large liquid surface for its detection. The theory of the phenomenon is that light coming from the Martian sky or clouds is reflected from the surface of the water and polarized. One ray coming through a double-image prism therefore shows the bottom of the Martian pool, while the other shows the sky reflected in its surface. One image therefore appears brighter than the other. In the case of a bucket of water the difference between two rays leaving its surface at an angle of 70° is readily recognized, and at lower angle the difference is very striking. The sensitiveness is greatly increased by combining a plate of quartz with the double image prism in the usual manner.

Lowell devoted his attention for many years to thoroughly establishing the details of the great Martian canal system, undeterred by much hostile and sceptical criticism.

In his paper: "The Optical and Psychological Principles Involved in the Interpretation of the So-called Canals of Mars" (*Astrophysical Journal*, July, 1907, p. 1), Professor Simon Newcomb laid down some tenets which should be considered in such observations as those of the canals. In his answer: "The Canals of Mars, Optically and Psychologically Considered. A Reply to Professor Newcomb," by Percival

Lowell (*Astrophysical Journal*, Oct., 1907), it was shown by Lowell that the suggested tests had been thought of and tried by him years before and with results quite different from those which Newcomb seems to have anticipated, for they proved conclusively that the "canals," whatever they might be, were at any rate not imaginary; that their occasional disappearance during long intervals, followed by a sudden reappearance in identical situations, demanded the hypothesis of intelligent control; that objections urged that lines as fine as those drawn by Lowell could not possibly be perceived under the given conditions were positively disapproved by reliable optical experiments; that simultaneous completely independent drawings by competent observers, with different instruments but otherwise under identical conditions, agreed with a remarkable degree of accuracy. Of course training of the eye is needed in such delicate work and all is not seen at the first glance. Dr. Lowell was much pleased when Professor Robert W. Willson of Harvard University, when on a visit to Flagstaff, saw the canals "better and better each night until finally doubles and straight narrow lines" and then "blue water around the melting cap" were seen. Professor Edward S. Morse, consummate artist and keen observer, also had no difficulty in seeing these much disputed objects after a little training in Dr. Lowell's methods.

Professor Newcomb commenting on the large amount of light lost through aberration in the best refracting telescopes says: "The injurious effect of this dispersed light may be lessened by the use of a suitable absorbing screen, which is among the devices used at the Lowell Observatory. I do not know how successful this device has proved in bettering the definition, but it seems quite certain that it could not be so applied to bring the bright central image within the limits of 0." 10. Whether the method thus somewhat cursorily dis-

missed is the secret of a large part of the success of the Lowell observers, I cannot say, but any "device" calculated to improve efficiency is worth trying. Professor Newcomb was evidently unconvinced; but he was at least respectful and did not indulge in the cheap jibes which some have applied to the "wonders" of the Lowell Observatory with the innuendo that they are nothing but fiction.

The doubling of certain canals at times, while at other times they appear single, has been attributed by some to an optical illusion, by others to a blending of two images into one indistinct blurred image through bad seeing, etc. Hence the phenomenon was made the subject of a most critical study by Dr. Lowell who found that the missing one of a pair simply faded away, leaving the other in exactly its old position and with identical width under the very best definition. Possibly at times there may not be water enough to keep two canals in commission and therefore one of them is shut off. Intelligent supervision is the best explanation. The reddish ochreous tint of much of the surface, besides giving to the planet its prevailing ruddy hue, is one of the most usual characteristics of desert sands.

Of atmospheric phenomena we may note the greater brightness of the limb which suggests the presence of morning and evening mists. Nocturnal dew is to be anticipated. Changes in the green areas suggest that nocturnal rains sometimes occur although, except for the general and persistent mantle of cloud over the polar regions in winter, clouds in the day time are rare. When, very rarely, an area of cloud appears and lasts for several days, it is almost invariably associated with one of the green *maria*, where alone a local source of enough humidity to breed cloud can be found. We have learned that there are no oceans or mountains on Mars, but very rarely a cloud has been seen to project beyond the limb, ascending to a height of

as much as fifteen miles. Being of a yellowish color, these local and temporary clouds are probably dust whirls or desert siroccos rather than thunder storms. The close association of atmospheric water-vapor with the melting snow cap and its relative absence from the equatorial regions, together with the elaborate world-wide system of canals, confirms Dr. Lowell's hypothesis, that Mars is a parched world requiring artificial contrivances to make it habitable.

Coming now to the major planets, Jupiter, Saturn, Uranus, and Neptune, whose distances from the sun are 5.2, 9.5, 19.2, and 30.1 astronomical units and which receive therefore only $37/1000$, $11/1000$, $3/1000$, and $1/1000$, respectively, of the radiant energy per unit of surface which the Earth gets, if the protective atmosphere were proportional to the masses (86.5, 70.9, 31.9, 34.7, the Earth being 1.0), Jupiter which is the nearest would get the most, while Uranus and Neptune which are the farthest away and need the most protection, would receive the least. But by that wonderful Divine Providence which always regards first the needs of life, the absorbent power of the atmosphere, on which retention of a planet's heat largely depends, instead of varying with the planet's mass, increases precisely as the distance does, apparently without any regard for the mass.

DISCUSSION OF THE APPARENT ALBEDOES OF THE MAJOR PLANETS

Müller's stellar magnitudes with Lowell's semidiameters give the following extraordinary progression in the apparent albedoes of the major planets:

Jupiter	0.707	(geometrical albedo)	
Saturn	0.849	"	"
Uranus	0.807	"	"
Neptune	0.963	"	"

which show a decided tendency for the albedo to increase with

the distance of the planet from the sun, which is exactly the opposite of what we should expect from their spectra; because the atmospheric absorption bands of the major planets increase in intensity from Jupiter to Neptune, becoming very strong in the latter, as may be seen from Slipher's spectograms (Lowell Observatory Bulletin, No. 42), so that from this cause alone, it seems certain that proportionately less light must be reflected from Neptune than from Uranus, less from Uranus than from Saturn, and less from Saturn than from Jupiter. We may admit that a difference in the cloudiness may interfere with the smoothness of the progression and may even reverse the order in individual pairs, as in Jupiter and Saturn where the dark, or less clouded belts of Jupiter are much more pronounced than those of Saturn; but we should not expect that such differences in planets which have a strong general resemblance could reverse the entire series.

Now, since the observations of Neptune for stellar magnitude yield an apparent albedo nearly equal to unity, which is very improbable and indeed incompatible with the great atmospheric absorption of that planet, we have here conclusive evidence of the *presence of some progressively increasing error* whose sources have not been detected hitherto.

The discrepancy may be explained on the following principles: It is known that the absorption bands of the planetary atmospheres are exceptionally strong in the spectra of Uranus and Neptune, especially in the latter, and that they are very much stronger at the red end of the spectrum, the shorter waves being so much less absorbed that these planets have a blue-green color. But the greater sensitiveness of the eye to blue in faint images where rod vision becomes especially effective, will cause an over-estimate of the brightness of such faint blue-green images and one which is greater the fainter the image, thus greater for Neptune than for Uranus. This error from

neglect of the color-equation appears to be about 0.4 magnitude for Uranus and 0.8 magnitude for Neptune. Applying these corrections to Müller's measures, the discrepancies in the albedoes are entirely removed for these two planets.

Uranus, geometrical albedo = 0.558, spherical = 0.419.

Neptune, geometrical albedo = 0.461, spherical = 0.346.

The value for Uranus may be confirmed in another way. Lampland found it necessary to expose a photographic plate twelve times as long for Uranus as for Saturn. On account of the imperfect registration of the fainter light the photographic effect of Uranus must be doubled to give equality in a comparison with Saturn. Hence since Uranus is twice as far away as Saturn from the sun and is illuminated by a light one-fourth as strong, the geometrical albedo of Uranus

$$= 2 \times 4/12 \times \text{albedo of Saturn}$$

$$= 2/3 \times 0.849 = 0.566 \text{ as compared with our first corrected value, } 0.558.$$

The albedo of Saturn was obtained at a time of the disappearance of the rings and therefore is to be attributed to the ball. It appears to indicate that Saturn is more clouded than Jupiter, or else that its clouds are more highly reflective.

Of Jupiter, George F. Chambers says: "Some observers have expressed the opinion that it possesses inherent light of its own. Speculations, however, such as this must always be received with reserve, because of the evident difficulty of making sure of the facts on which they must be based. One thing, however, seems less open to doubt. Bearing in mind the small amount of heat which reaches Jupiter from the sun, there is reason to infer that the clouds which certainly exist on Jupiter must owe their origin to the influence of some other heat than solar heat; in other words that Jupiter possesses sources of heat within itself." (The Story of the Solar System, pp. 119-120.)

Against expressions of such moderation no objection can be

urged except that they do not go far enough and do not reach the more serious difficulties.

Because of the small densities which have been assigned to the major planets: Jupiter, 1.38; Saturn, 0.75; Uranus, 1.28; Neptune, 1.15; that of water being unity, some have supposed that these bodies are greatly expanded by heat, in fact that they have never cooled from a primitive sun-derived molten state, that they must be, to say the least, red-hot. But the complete disappearance of Jupiter's moons in eclipse does not call for any such semi-solar function on the part of the planet.

Others have imagined a solid globe, but covered by boiling oceans sending up clouds of condensed steam. This hypothesis is equally invalid. The little *a* band of water-vapor in the spectrum of Jupiter is indeed very strong but not stronger than in our hottest and most humid equatorial regions. There are certainly oceans on Jupiter with abundant evaporation and cloud precipitation. Storms also occur and often a succession of them in a row along one of the belts. The storms are not so very much more extensive than our largest cyclonic areas. Their speed of translation often exceeds that of our storms, confirming the supposition that there is some other source of their energy than solar radiation. Phenomena resembling trade-winds occur and an equatorial belt of clouds, presumably with rains, but there are no seasonal changes. I must demur to the statements of Sir Robert Ball. He says:

All evidence points to the fact that the internal parts of the great planet which we are now considering must be in a highly heated condition. It is indeed probable that Jupiter is so hot that, even if there was a solid surface beneath that cloud-laden atmosphere, water could not rest upon it. It would seem that the temperature is such that the water would boil away from that surface, and be driven off into vapor. Let us imagine, for the sake of illustration, that this Earth of ours was to become so hot that even at the surface it was about the temperature of

boiling water, and was doubtless much hotter in the interior. Imagine the floor of the bottom of the sea to become similarly heated and to be supplied with practically unlimited heat from beneath. Then it is plain that all the water in every river and every ocean would be evaporated and turned into steam, and ascending into the atmosphere would form a stupendous mass of dense and impenetrable clouds. There can hardly be a doubt that something of this kind represents the present state of Jupiter. The constant passage of heat from the interior of the planet to its surface maintains enormous masses of material in the form of clouds in this atmosphere, while local inequalities in the transfer of this heat generate such disturbances that the incessant storms with which the mighty planet is distracted can be accounted for. (*Elements of Astronomy*, pp. 124-5.)

I must object to this view, if only on account of the spectroscopic evidence. But, besides this, there is evidence that solar radiation is still potent on Jupiter. Müller found that Jupiter shines with a greater brightness when spots on the sun are most numerous. There is a greater outpouring of solar heat at sun-spot maximum and hence the solar radiation is greater over a large extent of the Tropics, as Blanford showed in his "Indian Meteorologist's Vade Mecum." This leads to greater evaporation from the tropical oceans on this Earth and to greater cloudiness and precipitation in higher latitudes, and terrestrial temperatures are lowered in certain regions by the polar winds drawn in to restore equilibrium which has been disturbed by increase of tropical ascensional currents. Thus in the higher latitudes, mean temperatures were found to be lower by 1 or 2 degrees in sun-spot years, and the meteorologists of Europe and North America drew the erroneous conclusion from this partial evidence, that the sun was colder at the time when spots were numerous, whereas it is just the other way, as I showed in my paper: "The Variation of Solar Radiation." (*Astrophysical Journal*, April, 1898.) The proposition that the sun is hotter at maximum sun-spot epoch was rejected

by Abbot in the first edition of his work on "The Sun," but he has since withdrawn his erroneous views on this point. (Compare also my "Solar Radiation," pp. 631-633, where some of Newcomb's ideas are refuted.)

It appears, then, that Jupiter, as well as the Earth, feels the effects of the sun-spot cycle. Mars, too, is somewhat influenced. (See "Témoignage des Planètes concernant la Radiation Solaire," *Bulletin Astronomique*, Tome XXXIV, Juin-Jullet 1917, pp. 129-135.). Internal heat may be responsible for a part of the evaporation of water and its resulting abundant cloud formation, but it cannot overpower the solar effect. The source of this internal heat can now be more definitely stated. Dr. Percival Lowell, from a profound study of Saturn and its rings, was able to announce that Saturn does not rotate as one piece, but that it has distinct "confocal layers rotating faster within." Jupiter also presumably rotates in the same way, as well as the other giant planets. Indeed the same is true of the Earth, though to a much less extent. To this source and that of the radio-activity of some of its constituents, the present subterranean heat of the Earth, with the exception of some from local chemical action and heat developed by friction in the adjustments of isostatic equilibrium, must be attributed; for, though heat-conduction is a slow process, any original supply of heat would surely have been lost in the hundreds of millions of years of planetary duration, unless replenished.

It has been found that the temperature increases at the rate of about 50° C. to the mile [as we descend below the surface]. If this rate of increase were uniform, we should have a temperature of about 3000° C. at the bottom of the crust, a temperature which at the Earth's surface would be sufficient to fuse rocks of all kinds. Owing to the great pressure exerted by the crust, even the great temperature which must be below cannot fuse the rocks. In fact, the inference from tidal, earthquake, and latitude

observations is that the material below the crust is as rigid as steel. This inference or conclusion has not been questioned. How can this material be so rigid and yet yield to the loading and unloading of the crust? Here we must bring in the time element. The stresses resulting from the tide-producing forces of the moon and of the sun, the earthquake vibrations and the forces which produce variations in latitude act for very short times, for a few minutes or hours or for a day or a year. To these short stresses the material below the crust acts as a rigid body. However, the stresses resulting from the disturbances of gravitation act for thousands of years. To these long-continued stresses the material is plastic and yielding. (Dr. William Bowie, "Geology from the Isostatic Viewpoint," *Scientific Monthly*, Jan. 1926, p. 10.)

The principle of isostasy, first proposed by Pratt about seventy years ago, but given its name by Dutton, is now thoroughly established by the observations of Hayford and his co-workers in the United States Coast and Geodetic Survey and by Burrard of the Indian Trigonometric Survey who showed that the giant mass of the Himalayas is kept floating at its great height by the small average density of the block of which it forms a part. Meanwhile the bases of the continents yield and flow under the pressure of sediments accumulating in oceanic border synclines. Thus it is a fact that there is motion and flow in the solid land and it need not surprise us that Jupiter, though solid, yet flows. Given internal motion, there will be friction and production of internal heat. We accept the constant production of internal heat by the giant planets, and no doubt it is capable of supplying the deficiency of solar radiation due to the distance from the sun, when supplemented by the conserving properties of a deep protecting atmosphere. But that the heat so produced can expand the body of the planet and account for the low density is difficult to admit. That was a false trail. We should be prepared to recognize that there are probably unknown substances lighter

than water of which the outer planets are largely composed. We know that their atmospheres contain unknown substances. Why not the solid bodies likewise? A deep atmosphere also helps, but this alone cannot account for the difference in density between the terrestrial and the giant planets.

Jupiter has a very deep atmosphere. The red spot of an oval shape, about 27,000 by 8,000 miles in dimensions, which appeared in 1878 and lasted for several years, seems to have been an opening in an outer layer of cloud by which the sun's rays penetrated to a deeper layer of cloud or possibly to the solid surface, although it is highly improbable that any surface markings could be seen through so dense an atmosphere. The sunlight after passing twice through Jupiter's atmosphere must have encountered the equivalent of many terrestrial atmospheres, since it exhibits the brilliant red of our sunset skies.

Another indication of a deep atmosphere is where one of the moons has been occulted and then has reappeared at some distance from the limb, as though seen *through* the planet. Here the first disappearance must have been behind a cloud layer and the reappearance was through an opening in the same, while the final vanishing was either back of a deeper layer of cloud, or behind the genuine solid body of the planet. Again, the shadow of a satellite in transit has been seen double. The companion shadow, cast upon a lower layer of cloud and then seen dimly through the upper layer, must have appeared the fainter of the two. The difference of motion between Jupiter's clouds, or any aperture through them, and the shadow, ought to lead to a recognizable variety in the appearance. Proctor has computed such an observation by Trouvelot with the Harvard equatorial, and obtains the extraordinary figure for the depth of the second cloud layer below the first, of fully 8000 miles. Other cases, while less explicit, agree in making the depth of the second layer to be at any rate very great.

A thermal measure by Coblentz in the image of Jupiter gave -110° Cent. Here, as I have before explained, the heat is not that of the solid surface, but of an elevated layer of air, and a *very* elevated one, since the heat falls so far below what we find on the Earth. At any rate the observation annihilates the hypothesis of a red-hot Jupiter.

We have examined the scientific surmises concerning Jupiter. Opinions similar to those of Sir Robert Ball might be quoted from a large number of scientific treatises. It is the common conception of this, the largest and most magnificent of the planets, that it is tormented by boiling oceans and "distracted" by terrific storms; that it is a vast *inferno*, utterly unfit for human or any other habitation. But we have seen that the known facts are susceptible of other and quite different interpretations.

Swedenborg's first-hand evidence shows us a picture the reverse of this. Here is a world full of life and activity, where winter is unknown, where reigns perpetual spring; a world densely inhabited by human beings who are among the best in the universe. They live only about thirty of our years, which contain, however, about as many days or consecutive states of life as our lifetimes average, owing to the rapid rotations of the planet. Their lives are simple, but extraordinarily rich and full of genuine realities. Their chief concern in the earthly life is the rearing and instruction of their children "whom they love most tenderly." Beyond this, food and shelter is all they ask for. They have no anxieties. The fertile planet produces an abundance for all. They think much about the things of heaven and live happily with their conjugal partners. They do not care for mere doctrinal matters or sciences. *Life* is what concerns them. "It is common in the earth Jupiter for spirits to discourse with the inhabitants, to instruct them, and also to chastise them if they have done

evil" (E. U., n. 71); for there is some evil there, but under such guidance it cannot prevail. If the evil do not heed repeated warnings, they are deprived of earth-life. Instruction as to heavenly life is given by the Lord Himself, and also through spirits. They have not the art of writing and marveled much when Swedenborg told them about it. Hence they have no written laws and no "Word," except that spiritual instruction which is given to them by the living voice.

They said that they have no particular days set apart for divine worship, but that every morning at sun-rise, and every evening at sun-setting, they perform holy worship to their only Lord in their tents; and they also sing psalms after their manner. (E. U., n. 69.)

Their habitations were also shown to me; they are low and constructed of wood, but within they are coated over with bark of a pale blue color, the walls and ceiling being spotted as with small stars, to represent the heavens; for they are fond of thus picturing the visible heavens and stars on the insides of their houses, because they believe the stars to be the abodes of the angels. They have also tents, which are rounded above, and stretched out to considerable length, spotted also within with little stars in a blue plane. Into these they betake themselves in the middle of the day, to prevent their faces suffering from the heat of the sun. They are very attentive to the construction, neatness, and cleanliness of these their tents; they have also their meals in them. (E. U., n. 59.)

I have also been shown what sort of faces the inhabitants of the earth Jupiter have. . . . They were like the faces of the men of our Earth, fair, but more beautiful; there shone forth from them what was sincere and modest. (E. U., n. 52.)

Swedenborg says that

they who live in their warm climates go naked, except about the loins; nor are they ashamed of their nakedness, inasmuch as their minds are chaste, loving none but such as they are in conjugal connection with, and abhorring adultery. They were very much surprised at the spirits of our Earth, who, on hearing of their method of walking, and also that they were naked, made

a joke of it, and gave way to lascivious thoughts, without attending at all to their heavenly life. They said that this was a proof that things corporeal and terrestrial were of more concern to them than heavenly things and that things of an indecent nature had place in their minds. Those spirits of our Earth were told that nakedness gives no occasion either of shame or of scandal to such as live in chastity and state of innocence, but only to such as live in lasciviousness and immodesty. (E. U., n. 56.)

The allusion to "their method of walking" refers to this circumstance:

Swedenborg says,

I was further informed by the spirits from that earth, concerning various particulars relating to its inhabitants, as concerning their manner of walking, concerning their food, and their habitations. With respect to their manner of walking, they do not walk erect like the inhabitants of this and of several other earths, nor do they creep on all fours like four-footed beasts, but as they go along they assist themselves with their hands, and alternately half elevate themselves on their feet, and also at every third step turn the face sideways and behind them, and likewise at the same time bend the body a little, which is done suddenly; for it is thought indecent amongst them to be seen in any other point of view than with the face in front. In walking thus, they always keep the face elevated as with us, that so they may look at the heavens as well as the earth; holding the face downwards so as to see the earth alone, they call an accursed thing; the most vile and abject amongst them give in to this habit, but if they continue in it, they are banished from the society. When they sit they appear like men of our Earth, erect as to the upper part of the body, but they usually sit cross-legged. They are particularly cautious, not only when they walk, but also when they sit, to be seen with the face in front, and not as to the back parts; they are also very willing to have their faces seen because thence their mind appears; for with them the face is never at variance with the mind, nor indeed have they power to make it so; hence it evidently appears, on an interview with them, what dispositions they entertain towards all who are present, especially whether their apparent friendship be real or

forced, for this they never conceal. These particulars were declared to me by their spirits, and confirmed by their angels; hence also their spirits are seen to walk, not erect like others, but almost like persons swimming, appearing to help themselves forward with their hands, and by turns to look around them. (E. U., n. 55.)

The reasons given for this elaborate etiquette must seem largely imaginary, but good scientific reasons could also be given, were it not that the inhabitants of Jupiter have a particular aversion to the things of science, as will be shown in what follows. Their curious mode of walking, "almost like persons swimming," is a confirmation of what we have learned concerning the great density and depth of the Jovian atmosphere. It would not be easy to walk there in any other way.

The spirits and angels, who are from the earth Jupiter, in the GRAND MAN, have relation to the IMAGINATIVE PRINCIPLE OF THOUGHT, and consequently to an active state of the interior parts; but the spirits of our Earth have relation to the various functions of the exterior parts of the body, and when these are anxious to have dominion, the active or imaginative principle of thought from the interior cannot flow in; hence come the oppositions between the spheres of the life of each. (E. U., n. 64.)

On seeing horses, the spirits of Jupiter said, "that they also had horses amongst them, but of a much larger size, and that they were wild, running at large in the woods, and that when they come in sight, the inhabitants are terrified, although they never suffer any hurt from them; they added, that the fear of horses is innate or natural to them. This led me to a consideration of the cause of that fear, and that it seemed to be grounded in the spiritual signification of horses; for a horse in a spiritual sense signifies the intellectual formed of scientifics, and inasmuch as the inhabitants of Jupiter are afraid of cultivating the intellectual principle by worldly sciences, hence comes an influx of the fear of horses." (E. U., n. 60.)

Of the spirits of Saturn we are told that "they are upright,

and they are modest; and inasmuch as they esteem themselves little, therefore they also appear little in another life." (n. 97.) "They live divided into families, every family apart by itself." (n. 103.) "They worship our Lord, and acknowledge Him as the only God." (n. 98.) "They said, that on their earth there are also some who call the nocturnal light, which is great, the Lord, but that they are separate from the rest, and are not tolerated by them. That nocturnal light comes from the great belt, which at a distance encompasses that earth, and from the moons which are called Saturn's satellites." (n. 100.)

Saturn's rings were found by my former associate at Allegheny Observatory, Professor James E. Keeler, to be revolving most rapidly where nearest to the center. Thus they do not rotate as one piece but are made up of innumerable fine particles, revolving in independent orbits. These swarms of fine particles which compose the outer, or A and B rings, reflect the sunlight very perfectly, but apparently do not transmit any light, as they cast a black shadow on the ball of the planet. The innermost, or crepe ring, however, allows the ball of the planet to be seen through it with but little obscuration. The constitution of the rings, their being made up of discrete particles, cosmic dust, had been foretold by Roche and by Maxwell from theory, but it was very pretty to see it demonstrated spectroscopically.

Saturn's equator is inclined $26^{\circ} 49'$ to its orbit. It has therefore arctic regions, and as the period of its orbital revolution is 29.46 years, its winters must last nearly 15 years. The equatorial regions, however, are warm, though not so warm as those of Jupiter. Both Jupiter and Saturn have usually a broad equatorial cloud-belt, apparently not so much because the sun is shining overhead in these regions, for there is sometimes an equatorial dark belt and two broad bright belts in middle latitudes. Moreover in Saturn, with its tropics nearly 27°

from the equator, it seems to make little difference in the position of the cloud-belt, where the sun is. The cloud-belts also vary in number, as well as in the "trade-winds" which are strong owing to the rapid planetary rotation.

Swedenborg says that the dwellers on Saturn "are little solicitous about food and raiment; that they feed on the fruits and pulse which their earth produces, and that they are clothed slightly, being encompassed with a coarse skin or coat, which repels the cold; moreover that all on that earth know that they shall live after death; and that on this account also they make light of their bodies, only so far as that life, which they say is to remain and serve the Lord." (E. U., n. 103.)

"The inhabitants and spirits of the planet Saturn have relation, in the GRAND MAN, to the MIDDLE SENSE BETWEEN THE SPIRITUAL AND THE NATURAL MAN, but to that which recedes from the natural and accedes to the spiritual." (n. 102.)

Concerning a Planet belonging to Another Sun

At a time when I was broad awake, I was led as to the spirit by angels from the Lord to a certain earth in the universe, accompanied by some spirits from this orb; our progression was in a direction to the right, and continued for two hours. Near the boundary of our solar system there appeared first a whitish cloud, but thick; and behind it a fiery smoke ascending from a great chasm; it was a vast gulf separating, on that side, our solar system from some other systems of the starry heaven. The fiery smoke appeared at a considerable distance. [It will be understood that this was a *spiritual* appearance.] I was conveyed through the midst of it, and instantly there appeared beneath in the chasm or gulf several men who were spirits (for spirits appear all in a human form, and are actually men); I also heard them discoursing with each other, but whence they were, or of what sort, it was not given to know; one of them, however, told me that they were guards, to prevent spirits passing from this world to any other in the universe without having obtained leave. (E. U., n. 128.) After I was conveyed through that great chasm, I at length arrived at a place where I stopped; and im-

mediately there appeared to me spirits from above, with whom it was given to discourse; from their discourse and from their particular manner of apprehending and explaining things, I clearly perceived that they were from another earth, for they differed altogether from the spirits of our solar system; they also perceived from my discourse that I came from afar. (E. U., n. 129.)

After discoursing for some time on various subjects, I asked what God they worshiped? They said that they worshiped some angel who appeared to them as a divine man, being bright and shining with light; and that he instructed them, and gave them to perceive what they ought to do. They said further, that they knew that the Most High God is in the Sun of the angelic heaven, and that He appears to His angel and not to them; and that He is too great for them to dare to adore Him. (E. U., n. 130.)

Being questioned concerning the sun of their system, which enlightens their earth, they said,

that the sun there has a flaming appearance, and when I represented the size of the sun of our Earth, they said, that theirs was less; for their sun to our eyes is a star, and I was told by the angels that it was one of the lesser stars. They said also, that from their earth is likewise seen the starry heaven, and that a star larger than the rest appears to them westward, which was declared from heaven to be our sun. (E. U., n. 133.)

I was instructed that the inhabitants and spirits of that earth, in the GRAND MAN, have relation to somewhat in the SPLEEN, in which I was confirmed by an influx into the spleen whilst they were discoursing with me. (E. U., n. 132.)

*That Spirits from Other Earths See, Love, and Adore the
Lord Jesus*

There were certain spirits who knew from heaven, that on a time a promise was made to the spirits of the earth Mercury, that they should see the Lord; wherefore they were asked by the spirits about me, whether they recollected that promise? They said that they did recollect it; but that they did not know, whether the promise was of such a nature, as that they might depend with certainty on its accomplishment. Whilst they were

thus discoursing together, instantly the Sun of heaven appeared to them (the Sun of heaven, which is the Lord, is seen only by those who are in the inmost or third heaven; others see the light thence derived); on seeing the sun, they said, that this was not the Lord God, because they did not see a Face. In the meanwhile the spirits discoursed with each other, but I did not hear what they said. But on a sudden, at that instant, the Sun again appeared, and in the midst thereof the Lord, encompassed with a solar circle. On seeing this, the spirits of Mercury humbled themselves profoundly and subsided. Then also the Lord, from the Sun appeared to the spirits of this Earth, who when they were men, saw Him in the world, and they all, one after another, and thus several in order, confessed that it was the Lord Himself; this confession they made before all the company. At the same instant also the Lord, out of the Sun, appeared to the spirits of the planet Jupiter, who declared with open voice, that it was He Himself, Whom they had seen on their earth when the God of the universe appeared to them. (E. U., n. 40.)

Doubtless this experience was given in the presence of spirits from Mercury that they might disseminate the knowledge of it through the many worlds with which they are acquainted. Would that our men of science might humble themselves and lend their aid like these haughty ones!

There is much more about the great people inhabiting Jupiter. "As to what concerns their divine worship, it is a principal characteristic thereof, that they acknowledge our Lord as the Supreme, who governs heaven and earth, calling Him the ONLY Lord; and inasmuch as they acknowledge and worship Him during their life in the body, they hence seek Him after death and find Him; He is the same with our Lord. They were asked, whether they know that the ONLY Lord is a man? They replied, that they all know that He is Man, because in their world He has been seen by many as a Man; and that He instructs them concerning the truth, preserves them, and also gives eternal life to those who worship Him from a principle

of good. They said further, that it is revealed to them from Him, how they should live, and how believe; and that what is revealed, is handed down from parents to children, and there flows forth doctrine to all the families, and thereby to the whole nation which is descended from one father. They added, that it seems to them as if they had the doctrine written on their minds, and they conclude so from this circumstance, because they perceive instantly, and acknowledge as of themselves, whether it be true or not what is said by others concerning the life of heaven in man. They do not know that their only Lord was born Man on our Earth; they said it is of no concern to them to know it, only that He is Man and governs the universe. When I informed them that on our Earth He is named Jesus Christ, and that Christ signifies Anointed or King, and Jesus, Savior, they said, that they do not worship Him as a king, because king suggests the idea of what is worldly, but that they worship Him as a Savior. On this occasion a doubt was injected from the spirits of our Earth whether their only Lord was the same as our Lord, but they removed it by the recollection that they had seen Him in the Sun, and had acknowledged that it was He Himself, Whom they saw on their earth. (See above, n. 40.) On a time also the spirits of Jupiter who were with me, were seized with a momentary doubt, whether their only Lord was the same with our Lord; but this doubt, which was instantaneously injected, was also instantaneously dispersed; it was suggested by an influx from some spirits of our Earth; and what surprised me much on this occasion, the spirits of Jupiter were so ashamed of themselves, for having doubted herein, though but for a moment, that they requested me not to publish it, lest they be charged with any incredulity, when yet they were now convinced of the truth more than others. They were most exceedingly affected and rejoiced when they heard it declared that the only Lord is

alone Man, and that all have from Him what entitles them to be called men; but that they are only so far men, as they are images of Him, that is as they love Him, and love their neighbor, consequently, as they are principled in good; for the good of love and faith is an image of the Lord." (E. U., n. 65.)

There were with me some spirits of the earth Jupiter, while I was reading the seventeenth chapter in John, concerning the Lord's Love, and concerning His Glorification; and when they heard the contents, a holy influence seized them, and they confessed that all things therein were divine; but at that instant, some spirits of our Earth, who were infidels, suggested various scandals, saying, that He was born an infant, lived as a man, appeared as another man, was crucified, with other circumstances of a like nature; but the spirits of the earth Jupiter paid no attention to these suggestions; they said, that such are their devils, whom they abhor; adding, that nothing of a celestial principle has any place in their minds, but only an earthly principle, which they called dross; and which they said they had discovered from this circumstance, that when mention was made of going naked on their earth, obscene ideas immediately occupied their thoughts, and they paid no attention to their celestial life, which was also spoken of at the same time. (E. U., n. 66.)

Of Mars:

In regard to divine worship, as practised by the inhabitants of that earth [Mars], they informed me, that they acknowledge and adore our Lord, saying, that He is the only God, and that He governs both heaven and the universe; and that every good thing is from Him and that He leads and directs them; also that He often appears amongst them on their earth. It was then given me to tell them, that Christians also on our Earth know that the Lord governs heaven and earth, agreeably to His own words in Matthew, "*All power is given to Me in heaven and in earth,*" xxviii, 18; but that they do not believe it like the inhabitants of the earth Mars. They acquainted me further, that on their earth the inhabitants believe, that with themselves there is nothing but what is filthy and infernal, and that all good is of the Lord; yea, they added that the Lord draws them out of hell,

and continually keeps them from falling into it again. On a certain occasion when the name of the Lord was mentioned, I observed that those spirits humbled themselves in such inward and profound abasement as no words can describe. (E. U., n. 91.)

Of the spirits of Saturn we read:

In acts of divine worship they are exceedingly humble, for on such occasions they account themselves as nothing. They worship our Lord, and acknowledge Him as the only God. The Lord also appears to them at times under an Angelic Form, and thereby as a Man, and at such times the Divine beams forth from the face and affects the mind. (E. U., n. 98.)

Why the Lord was Willing to be Born on Our Earth and not on another

There are several reasons, concerning which I had information from heaven, why it pleased the Lord to be born, and to assume a humanity, on our Earth, and not on another. "*The PRINCIPAL REASON was because of the Word, in that it might be written on our Earth; and when written be afterwards published throughout the whole Earth; and when once published be preserved to all posterity; and that thus it might be made manifest, even to all in another life, that God was made man.*" (E. U., n. 113.)

Swedenborg's wonderful scientific experience of "Other Worlds than Ours," received "*at a time when I was broad awake,*" he tells us, and with trained faculties, should take the place of the unreliable surmises which have hitherto passed for science, but which are in most cases unworthy of that appellation. The avidity with which these "traveler's tales" have been swallowed without demanding their credentials, and the scant respect which has been paid to the "rightful heir" and faithful witness are a reproach to genuine science.

In concluding this story of life on other orbs, I ask the con-

sideration of that LIFE OF ALL WORLDS, without Whom no world would be possible.

THE VIRGIN BIRTH OF JESUS—SCIENTIFIC ASPECTS

All of the process of Creation is accomplished by Divine Influx into nature. "All things are created by the Lord through the Sun of the spiritual world, not through the sun of the natural world." (Divine Love and Wisdom, n. 153.) There are spiritual substances mingled with the natural substances, otherwise the marvelous development of natural forms and the retention of inherited dispositions and qualities (which form the outward embodiment of an underlying soul) could not proceed and be preserved. (See True Christian Religion, n. 470.)

Man shares with the brute creation all the properties which are necessary for the creation of the body and, in addition, he has a fuller reception of Divine Influx, both immediate and through the spiritual world, which raises him above the brutes.

But the supreme example of embodiment is the entrance of the Divine into the world by the assumption of humanity through the Virgin Birth. In spite of various claims that this has been done not once but many times, I conceive that it can only have happened once in the Birth of Jesus, because never before did the supreme need arise for the Incarnation, at any rate not on this earth.

Lord Bacon, often considered to be the founder of the scientific method, said: "We have set it down as a law to ourselves, to examine things to the bottom, and not to receive upon credit, or to reject upon improbabilities, until there hath passed a due examination."

So-called philosophy is mainly speculation. Swedenborg's philosophy is a true spiritual science, not discarding the deductive method wherever it can be used legitimately, but resting mainly on experience, on "things heard and seen" in more worlds than one. Lord Bacon taught the inductive method, but Swedenborg practiced it and as regards spiritual science for a long time he stood alone. Sir Francis Bacon may have been the greatest poet of the ages, as well as the maker of the English language, as he demonstrated, when, in 1607, in his forty-sixth year, he put the finishing touches to the King James' version of the English Bible, and commemorated the event by joining the forty-sixth verse from the beginning of the forty-sixth Psalm to the forty-sixth verse from the end of that chapter in forming his pen name.

The discovery of Bacon's secret is due to Dr. Orville W. Owen of Detroit, Michigan.

But Bacon cannot as readily substantiate his claim to being the originator of the scientific method. See "The Myth About Bacon and the Inductive Method," by Professor Morris R. Cohen, *The Scientific Monthly* for December, 1926.

Seeing that we know but a minute fraction of what is to be known concerning the way in which suns and planets originate or concerning even the birth and growth of the tiniest organism, it ill behooves us to dogmatize as to what can or cannot be in nature, still less to assign limitations to the progressions in a world of pure spirit. Paraphrasing Tennyson:

Flower out of the crannied wall,
If I could pluck you out of your crannies,
And study you, root and stem and all,
I should know what God and man is!

Let me first dispose of the tales of other virgin births. None of these have the circumstantiality and the circumspection attaching to the accounts of the Birth of Jesus. They come

down to us from an epoch when all kinds of events were described in the exuberant language of mythology. We are not able to discriminate the mythical births of heroes from the myths attaching to various cosmical or meteorological processes no longer associated with myth, but then described in the language of fable. They are obviously apocryphal.

The story of the Virgin Birth of Jesus is entirely different. It has all of the strength of the best historical evidence. It has been corroborated in the mouths of two or more witnesses familiar with the facts, but exhibits those trifling divergences which are characteristic of independent narrations where there is no collusion. If the different narratives had been pure inventions, intended to deceive, the conspirators responsible for them would have taken pains to make them agree perfectly. Their slight divergences testify to the sincerity and truthfulness of the narrators. It is characteristic of the historicals of the Word that they make no attempt to hide or condone the mistakes or immoralities of its personages. We get the impression of essential truthfulness, and if there are apparent discrepancies, some of these are either capable of reconciliation or were never intended to be other than approximations, like some of the qualitative statements of a science which is admitted to be inexact. Where numbers are involved, Swedenborg shows that the approximation may be preferred to literal exactness because its correspondence conveys the spiritual sense better.

The story of the Birth of Jesus is wonderfully interesting and must have been the subject of much conversation among the early disciples, yet it is calmly told. It does, however, involve the direct impact of the supernatural in an age which was thoroughly materialistic. This, then, is the one element where natural science can infuse a doubt. And to meet this doubt and overwhelmingly refute it, Swedenborg—a man of science—was raised up and was given a commission and a supernatural

experience whereby he might execute it, which is so thoroughly established, so convincingly explained, so plainly presented without any frills or sensational episodes, that the fact of the supernatural as a part of the Divine Order—nay, as the most essential fact in that Order—is made known.

Dr. James John Garth Wilkinson, eminent as a man of science, puts the case thus:

Some people indeed have proposed, that theological time has passed away, that it was an infantine and comparatively savage condition of societies, a belief in nothings as the causes of all things; and that the scientific age has at length arrived, and positivism can be inaugurated; positivism being the widest and most sifted belief in the informations of the five senses, and in the laws deducible from these. The universality of those laws once attained, the mind has its fairly won scepter, and the world and all it contains lives, moves, and has its being in the genius of the immortal generations of mortal human selfhoods. But now it is pleaded *per contra* that the theological ages are not behind us, but before us; that on the ground of nature they are just beginning to dawn; that the birth of the Lord is a natural event, and that, consequently, there is a divine embryology, and a divine physiology, because there is a Divine man. Consequently there is a divine science which is positive. Not only positive in the truths it holds but positive, warring positive, from the love of salvation. Yet it is all compact of intellectual truth, and from the Redeemer it sheds natural light upon the birth, life, and death of every creature. For to the birth of the Lord in time, the whole world flowed on from the beginning; the fall of mankind, chieftainless, into ruins necessitated it. When it took place, a human nature was taken upon Him by the one Divinity who inhabits eternity. No condition of actual birth—a father and a mother—was absent. No greater mystery than any other birth attends this incarnation; nay, as we said before, lesser mystery, because there is a plain divine reason for the birth; and in its very terms a divine presence and power to cause it. That birth opened heaven, and the rifted sky was filled with the host of angels. The child Jesus was a human character with the divine soul within Him. In Him there was nothing intermediate be-

tween God and man, no inheritance of paternal evils. The purpose was redemption. The humanity was assumed that it might front the world in the world. The world had long been under expostulation by the Divinity above the world; but here it came for the first time face to face with the Divinity in the world. It could only be so by an organic acceptance, by a perfectly, yea divinely natural fact of birth. (*Human Science and Divine Revelation*, pp. 156-7.)

We live at a time when profound interest has been awakened in several great questions which are more or less open to scientific investigation, such as the mode of creation as viewed from the natural side, and the production by supernatural means of certain natural phenomena which throw an unexpected light upon the nature of matter and the physical basis of life. By some these investigations are turned in a materialistic direction, but those who have seen most deeply into the phenomena of nature begin to recognize a fundamental unity and relationship between the natural and the supernatural.

If we are to comprehend even slightly the Virgin Birth of Jesus we must know something about two things: Evolution and the Materialization of Spirit Forms. To this end there must be knowledge and acknowledgment of natural law and recognition that it is subordinate to spiritual law.

Every birth is at bottom a miracle. Every birth involves something of the supernatural. In the spiritual world are multitudinous spirit-forms, waiting to be embodied. When the right conditions arise—conditions which are both spiritual and natural—the spiritual forms are clothed with matter and are materialized. A long procession of plant and animal forms succeed each other through the geologic ages. Their study gives us the science of paleontology. Throughout the sequence we find a progressive development of forms fitted for higher uses, the result of a perpetual spiritual urge, an uplifting of

the material towards, or in the service of an ultimate spiritual perfection. As witnessed among the Vertebrata, Dana called this progression "cephalization."

Man is at conception a unicellular animal, a protozoan. By education through the discipline of long ages, the cells have obtained the power to multiply, combine, differentiate and develop under the influence of the aforesaid spiritual urge. The result is summed up in the embryology of the growing fœtus.

Occasionally the father is lacking and birth from an unfertilized female occurs; but as there is no special influx of a higher spiritual soul, nothing happens out of the ordinary and such unisexual generations usually run out very quickly and finally require the intervention of a male, or they perish. Though bearing witness to a certain variety in the phenomena of generation, these things have nothing in common with our subject, except to assure us that departures from ordinary procedure are not unknown.

The birth of Jesus was unique. So was His death and His passing was attended by strange natural phenomena—darkness "over the whole land" from the sixth to the ninth hour "the sun's rays failing" (Luke xxiii, 45) "as if nature herself for her God was lamenting," the rending of the temple-veil, as Jesus with a loud voice "yielded up His spirit," the earthquake, the rending of the rocks and the opening of the tombs, so that "the centurion, and they that were with him watching Jesus, when they saw the earthquake, and all the things that were done, feared exceedingly, saying, Truly this was the Son of God" (Matt. xxviii, 54).

"He was cut off out of the land of the living; for the transgression of My people was He stricken" (Isa. liii, 8). Yet birth and death alike were relatively but incidents in a far greater work, in that conquest of humanity which cul-

minated in the overthrow of the power of the hells. The essentials of the assumption of humanity by the Lord were Salvation, Redemption, and Glorification.

If we must descend to "scientific aspects," let us compare a few of the data of animal life.

The extensive researches of Professor Jacques Loeb led to his discovery that the eggs of certain marine animals could be artificially fertilized by chemical means. He concluded that one function of the sperm was to introduce a substance into the egg which facilitates the production of the fertilization membrane and that the same could be accomplished by various physical and chemical agents. However, none of these artificial fertilizations progressed beyond a certain rudimentary stage, and Loeb's attempt to establish a "Mechanistic Conception of Life" was a failure, except that it brought forward various means which no doubt are instrumental in aiding the development of life. Thus he found that by slightly altering the composition of sea water, the eggs of a given marine species could be fertilized by sperm from various other species (conveyed through the sea water) which ordinarily would have no effect, and that thus crosses could be produced.

These experiments are ingenious and important in their own field, but they do not supersede the need of a spiritual source of life nor of the entrance of unseen *spiritual* substances together with the natural material.

That which the male element contributes to generation is a specific energy (from a spiritual source) which starts the vital process. By the laws of heredity, the perfect life and character of Jesus demand a special Divine initiation.

Science, today, is making an intensive study of heredity which is not yet completed. As far as this study has gone, it confirms Swedenborg's statement that the interior essential or spiritual principle of everyone is given through the father.

One of the most extraordinary examples is the case of the descendants of President Dwight, where through five generations a long succession of college presidents, college professors and scholars of note, handed on the torch of learning. On this list are no less than seven college presidents in addition to the original ancestor, five professors and four instructors in colleges, and at least three individuals of scholarly attainments who were not teachers.

This derivation from the soul of the father will be most easily recognized where the ruling love has been for spiritual and mental things.

Says Swedenborg: "What a man derives from his father remains forever; but the Lord's inheritance from Jehovah, as was said, was the Divine" (Heavenly Arcana, n. 1414). A man also derives a certain spiritual quality from his mother together with the things of the body, but this hereditary nature from the mother belongs to the lower or natural mind and "is something corporeal which is dispersed when he is being regenerated" (Ibid). Still what we receive from our mothers is not exactly or absolutely "dispersed" but rather is modified and becomes the man's own characteristic form, which gives him individuality, and remains after death as the external covering of the spirit, or limbus. Without this containment man could not endure eternally. To spiritualism with all its faults, and they are many, we are indebted for much confirmation of Swedenborg's teaching concerning the limbus.

Now the Lord Jesus during His earthly life did not merely *modify* His maternal inheritance (as man does, so that in a sense man may be said to "disperse" or dissipate his maternal inheritance) but with the Lord the finite quality of the corporeal from the mother was gradually removed and a Divine quality was substituted in its place, so that at last "all was Jehovah," down to the flesh and bones. But this could not

have been done had not the everlasting paternal inheritance been from the Divine by Virgin Birth. The "Arian heresy," so named by Swedenborg (T. C. R., n. 137), strikes at the very root of the Incarnation and of the Christian religion founded upon it. Someone has said that if the Virgin Birth of Jesus had not been revealed, it would have been necessary to invent it as a plausible scientific hypothesis in order to account for His life and inheritance.

Professor E. B. Wilson, our foremost student of the wonders of the minute internal structure of the cell and of the extraordinary changes which take place in its development and especially in the mitotic phenomena of the generative cells,—in describing the discoveries in experimental embryology with which the names of Driesch, the Hertwig brothers and Boveri are associated, notes results where two eggs were combined, also where only a piece of an egg was used, and yet the resulting creature was entirely normal; and he says: "How shall we deal with these facts under the mechanistic assumption of an original fixed structural pattern in the egg? Or if we prefer the other horn of the dilemma, granting that the egg can at will make over the original pattern so as to fit a new emergency, what kind of original configuration in the germ makes possible such an operation and determines its character?"

The answer to these questions is not difficult if we admit a guiding spiritual form, which is the soul of the creature, and which selects from the materials presented to it, those which will serve its purpose.

A still more difficult question and one which from the material side alone would be quite insoluble, is the explanation of the seemingly incredible dematerialization of the living human body with all its intricate cell-structure and delicately balanced mechanism, and its subsequent restoration. Yet these things

are substantiated by numerous modern instances and were known of old.

In Acts xii, 6, we read how Peter in prison "was sleeping between two soldiers bound with two chains; and guards before the door kept the prison." At the command of the angel the chains fell from Peter's hands and the iron gate is said to have "opened to them of its own accord." Here either the iron chains and fastenings of the gate must have been dematerialized long enough to permit the escape, or else the material body of Peter vanished and was restored unfettered. Either way, the escape requires an interference with nature from the spiritual side. Both modes are now known to be possible.

In recent times we have had some extraordinary examples of the materialization of spirit-forms which merit our study. They demonstrate that spirit can clothe itself with matter—a fact which materialism must accept. They also bear witness to unexpected properties of matter. As a whole, the things produced are not permanent and yet there have been productions of certain organic material structures, such as hair which is a comparatively lifeless thing, or about the lowest thing in the life-scale, and these have proved capable of preservation. Some of these things resemble the occurrences of the age of miracles. Apparently they are allowed to come back at the present time in order that we may study them scientifically and assure ourselves that the miracles of yore were authentic facts. Similar miracles are repeatedly described in the Word. They now occur under test conditions and have been studied by such investigators as the chemists, Dr. Robert Hare and Sir William Crookes, by the astronomer Professor Zöllner, by Baron Schrenck von Notzing who has brought to bear the most searching photographic tests which it is impossible to overthrow, and by the engineer, Dr. W. J. Crawford, who by means of a series of carefully designed experiments proves the

existence of cantilever structures, perfectly invisible, but capable of supporting heavy weights and controlled by invisible discarnate spiritual beings who follow his instructions intelligently and aid him in every way. These investigations are scientific in every sense of the word. They were conducted by men of the highest reputation and inventive genius. These men, without any thought of the bearing of their work on the disclosures of their scientific colleague of a former age—Emanuel Swedenborg—are piling up testimony which needs his philosophy for its explanation. The things which are of most interest in these experiments, scientifically, are the materialization and dematerialization phenomena and the exhibition of powerful forces derived from the living human body.

The Word of God contains numerous descriptions of spirit-materializations and various supernatural occurrences or so-called miracles. These are apt to be rejected by the materialistic sceptics, as being instances of poor observation, overcredulity of witnesses, or of deliberate falsification of the records. Perhaps we shall never be able to convince one of this disposition, but let us appeal to those who are open-minded.

When the "angel of the Lord descended from heaven" on the Easter morning, he *might* have been seen by the Roman soldiers with their spiritual eyes, had they been capable of having their spiritual sight opened. But, since it is said that the angel "came and rolled away the stone and sat upon it. His appearance was as lightning, and his raiment white as snow, and for fear of him the watchers did quake and became as dead men" (Matt. xxvii, 2-4); since also the stone was a *material* body, said to have been "exceeding great" (Mark xvi, 4) therefore the angel must have exerted *physical* force and had a materialized form which needed only natural vision to be seen by natural men. The occasional materialization of spirits

has now been scientifically demonstrated, confirming the Scripture account which distinctly implies that the mighty angel was a spirit materialization.

Swedenborg comments on the great power of the angels and asserts that it can be exercised even on the plane of nature (H. H., n. 228-233), but does not enter into explanations. We are just beginning to confirm his statements.

The Lord Jesus after His Resurrection said to the affrighted disciples, who supposed that they had seen a spirit: "Why are ye troubled? and wherefore do questionings arise in your heart? See my hands and my feet, that it is I myself. Handle me and see; for a spirit hath not flesh and bones, as ye behold Me having. And when He had said this, He showed them His hands and His feet" (Luke xxiv, 38-40). This is the spiritual signification:

"The Lord disclosed to the disciples that He had . . . made Divine the whole of His Human even to its Natural and Sensuous, which is signified by the hands and feet; by the hands and feet is signified the ultimate of man which is called the Natural, by flesh its good and by bones its truths; for all things in the human body correspond to spiritual things; the flesh to the good of the natural man, and the bones to its truths." (Apocalypse Explained, n. 619¹⁵.)

The Lord "took from the sepulcher when He arose, the whole human body, both the flesh and the bones . . . unlike every other man." (True Christian Religion, n. 170.)

After the Lord's Glorification of His Human the influx into the very atoms of the physical structure of the body of the Lord Jesus was no longer mediate through the spiritual world, but immediate from the Sun of heaven. The material vanished to sensuous apprehension and left nothing behind, for nothing was found in the tomb. The physical body was dematerialized and became a wonderful Divine "limbus,"

analogous to the limbus of man, a perpetual intermediate between man and God, a sublimation far beyond our comprehension and too holy for words, but capable, when the need arises, of being let down to the plane of sensuous apprehension. The nearest approach that we can make to a description of the body which was flesh and bones such as no spirit has, is to say that it was no longer mere matter but had become Divine Substantial. As such it could pass through closed doors ("When therefore it was evening, on that day, the first day of the week, and when the doors were shut where the disciples were, for fear of the Jews, Jesus came and stood in the midst, and saith unto them: Peace be unto you," John xx, 19); and yet at will the Lord could let down the Divine influx to the plane of nature and ultimate or materialize flesh and bones in accommodation to the states of belief of the disciples, which did not rise much above material things. Jesus said: "Greater things than these shall ye do because I go to the Father." Are not the materializations and dematerializations of the present day things of this order? Dr. Crawford's circle always began their proceedings with prayer and the singing of a hymn. As professed disciples of the Lord we may believe that their prayer was heard.

When Jehovah assumed the human by the Virgin Mary, the inmost soul of that little infant was Divine, but its successive coverings from the Angelic Heavens and World of Spirits—the spiritual and natural minds in their series—were only feeble beginnings, as they are in ordinary human infants, yet with a difference, for these feeble beginnings were essentially Divine and uncontaminated by inherited internal evils, as they would have been had the procreation been through a human father. Finally, the outermost degrees—the limbus and the corporeal and sensual—taken from the mother, *were* contaminated by tendencies to evil, but these were successively

removed by resistance to evil in terrible temptation combats, which began even in earliest childhood. All through the earthly life of the Savior, He was continually putting off something of the finite and bringing down something of the Divine Celestial in its place; until at the end He put off all of the infirm humanity—the son of Mary—and reascended into the Divinity, retaining His now Glorified Humanity. “With the Lord all is Jehovah; not only His internal and His interior man, but also the external, and the body itself; and therefore it is He alone who rose into heaven with the body also” (Heavenly Arcana, n. 1729). Yet these experiences of earth-life, in which the Divine touched the human and glorified it, will never be lost. “As the Father hath life in Himself, so hath He given unto the Son to have life in Himself.” They are the precious heritage of humanity throughout the ages. They have shown us what God is like. “No man hath seen God at any time. The only begotten Son who is in the bosom of the Father, He hath declared Him.” Henceforth we preach not, with Paul, “Jesus and him crucified,” but *Jesus and Him Glorified*.

The appearance of the risen Jesus to the disciples was a genuine materialization, but a Divine Substantial with Infinite Power was back of it. He had materialized the wine at the marriage-feast in Cana of Galilee, and the bread and fishes with which multitudes had been fed. Now He materializes Himself! Jehovah had manifested Himself of old, but it was by filling angels with His spirit and presence. Such were the angels, also called men, who appeared to Abraham by the oaks of Mamre. That they were materializations is evident, not only because they are called “men,” but because they accepted the food which Abraham provided “and they did eat” (Gen. xviii, 8).

We recall also that at the last appearance of the risen Jesus

to His disciples, recorded in Luke (xxiv, 41-43) "He said unto them: Have ye here anything to eat? And they gave Him a piece of a broiled fish, and a honeycomb. And He took it and ate before them." Hence the body by which He manifested Himself was certainly materialized. Yet on this very occasion, when He had led them out as far as Bethany, "He was parted from them and was carried up into heaven." Surely this was no ordinary body.

The body which passed through closed doors was a spiritual, that is to say, a dematerialized body, for matter cannot pass through matter; but the body which the disciples were invited to handle and which was unlike that of a spirit in that it had flesh and bones, was a Divine materialization.

Similarly the two at Emmaus at first supposed the Lord to be an ordinary wayfarer, like themselves, but afterwards "their eyes were opened, and they knew Him; and He vanished out of their sight" (Luke xxiv, 31). The eyes which were opened were the spiritual eyes. The vision before the opening was natural. In treating of similar openings of the spiritual eyes, Swedenborg says:

All things in the spiritual world . . . are seen by man when he is withdrawn from the bodily sight, and the sight of his spirit is opened. This is effected in a moment, when it pleases the Lord that man should see spiritual things. And then he is not aware but that he sees them with the eyes of the body. Thus angels were seen by Abraham, Lot, Manoah and the prophets. Thus the Lord was seen by His disciples after His resurrection; and in like manner, too, have angels been seen by me (Heaven and Hell, n. 76).

This passage does not enter into particulars, but the statement that the transition from natural to spiritual vision can be "effected in a moment," so that possibly the individual perceiver might not be aware of the change, is well illustrated by the incident at Emmaus. The angels (men) who visited

Abraham at Mamre and partook of his food, "went toward Sodom; but Abraham stood yet before Jehovah" (Gen. xviii, 22). In his conversation with the angel of Jehovah, Abraham had "in a moment" entered into the state of his interiors. The narrative does not discriminate in this respect, but we can interpret for ourselves. When the angel of Jehovah appeared to Manoah and his wife, the offering of food was refused, and "it came to pass, when the flame went up toward heaven from off the altar, that the angel of Jehovah ascended in the flame of the altar" (Judges xiii, 20). By this "Manoah knew that he was the angel of Jehovah," or, as he said, "we have seen God"; but except for such things as the context furnishes, the percipients knew not whether they were in the spirit or in the body. The appearance of the Lord to Mary and Peter may have been spiritual openings, but where the disciples' food was eaten, a distinction must be made.

Unlike the invitation to the disciples to "handle" Him, the Lord's words to Mary on the resurrection morning were: "Touch me not, for I am not yet ascended to the Father" (John xx, 17), as if some last step in the Glorification had not been completed. He had not yet made His humanity Divine Love in all its fulness.

Many instances are recorded in the Word of the "opening" of the spiritual eyes, as when the servant of Elisha "saw, and, behold, the mountain was full of horses and chariots of fire round about Elisha," when the angels appeared to the shepherds at the Lord's birth, when John in Patmos was "in the spirit on the Lord's day," when to Ezekiel "the heavens were opened" and he saw "visions of God," and again when he saw "in the visions of God . . . as it were the frame of a city" and the temple which had been destroyed, but whose counterpart still existed in heaven.

Before the Incarnation, Jehovah manifested Himself by

filling an angel with His presence. Doubtless the Lord can still employ angels as his messengers, but He is now also able to appear in His own person. He thus appeared during the forty days after His resurrection, at one time to as many as five hundred of the disciples (I Col. xv, 6). Some suppose that after the Ascension, this manner of manifestation ceased, but there is no reason to suppose that it has ever been abandoned. The Lord is still able to appear in His own personality to either angels or men.

Saul on the way to Damascus, when he saw the light from heaven which blinded him, "fell upon the earth and heard a voice saying unto him: Saul, Saul, why persecutest thou Me? And he said: Who art thou, Lord? And He said: I am Jesus whom thou persecutest" (Acts ix, 4-5). And when he had been led blinded into the city, Ananias was sent to him" and laying his hands on him said: Brother Saul, the Lord, even Jesus, who appeared unto thee in the way which thou camest, hath sent me, that thou mayest receive thy sight, and be filled with the Holy Spirit" (Acts x, 17).

Stephen when about to suffer martyrdom saw the Lord Jesus in the opened heavens. So do all of the angels see the Lord in His Divine Human form surrounded by the Sun of Heaven.

Swedenborg, in a dream, shortly before his illumination saw the Lord and, as it were, lay on His bosom and looked at Him face to face. This, however, may have been a representation such as is given to many of us by the angelic spirits who watch over us during sleep. But subsequently the Lord appeared to him when fully awake and, as he tells Robsahm: "He then said that He was the Lord God, the Creator of the world, and the Redeemer, and that He had chosen me to unfold the spiritual sense of the Scripture, and that He Himself would show me what I should write on this subject." And since Swedenborg expressly declares that he did not receive this reve-

lation from any angel, we must presume that this was indeed an appearance of the Lord in His own person. Indeed, this is expressly declared in True Christian Religion, n. 779: "That this Second Advent of the Lord is effected by means of a man, before whom the Lord has manifested Himself in Person, and whom He has filled with His Spirit, to teach the doctrines of the New Church through the Word from Him."

Dr. Wilkinson, more careful of his logic than his fellow scientists, insists that the succession of natural organisms in past ages was not evolved from matter but *devolved* through or by means of matter, from spirit. And he instances the materialization phenomena as a proof that this method of creation of human forms is entirely similar to the normal one. He says:

Now strangely enough the phenomena called in the aggregate Spiritualism, have furnished incontestable examples of a contrary mode of Evolution, and it is a well-known circumstance that more than one renowned Naturalist and Darwinian Evolutionist has witnessed these peculiar facts, and endorses them. The production of spirit Forms, Arms and Hands, which has occurred to Seance-People without doubt or question, furnishes a more ready way for the appearance and materialization of organic forms, than the slow and altogether assumed mode of protoplasm struggling upwards through infinite ages into Lions and Elephants. I have seen such things, and they were instantaneous, and as good specimens of organism as any beast or bird on earth. Here is a method of production from the other side of the walls of nature, which might coach the scientist fancies to a better view of spiritual forces. Of course the appeal can only be made to those who concede the existence of these spiritualistic marvels. But it is remarkable that these persons have not made use of the conception of devolution which such instances portend. Moreover, the history of the appearance of persons to their friends at the moment of death, shows the production of human forms complete in a moment, and attests that the nature of the world is very ready to conceive and operate such organic forms. (The Greater Origins and Issues of Life and Death, p. 26-27.)

But while it is possible for a spirit to improvise or materialize a body, such a body cannot be permanent. Hence Jehovah when He took upon Himself human nature, formed the body by the slow process of gestation in the womb of a virgin and thus descended to the human plane, yes, down to the animal level, for that is what the progression from conception to birth means, namely, the ascent from animal to man. And He did this in order that He might have power in ultimates and might build up a body and a human limbus "formed out of the purest substances of nature" which eventually might be glorified down to the flesh and bones, or be made Divine-Substantial. This glorified Body He forever retains. It is the "Son of Man," the Divine Humanity. In it He was seen by Saul on the road to Damascus, but because Saul's life had not been in harmony with the Lord's life, the vision blinded him. John, the beloved, saw to the very inmost of the throne of God, saw the Lamb in the midst of the throne and was *not* blinded by the vision. As glorified Son of Man, the angels who are nearest to Him see Him always; and so at times did the Lord's servant, Emanuel Swedenborg.

The important points about the Incarnation are, that every birth involves something of mystery, some special inflowing of the only life of the Universe which is the Divine Life; that never had there arisen such a great need for a direct Divine interposition in order to save the world; that every birth requires the admixture of spiritual substances with the natural substances of earth; that there was no violation of law in the Virgin Birth of Jesus, but simply an exceptional quickening of the ordinary processes, a more immediate and fuller reception of the same Divine Power which ever and eternally creates the heavens and the earth. "Jehovah looked and there was no man. Therefore His own arm brought salvation."

NOTE: The distinguished chemist, Joseph Priestly, who, in spite of contumely, rejected the doctrine of Calvin and founded the Unitarian movement, may have "spoken a word against the Son of Man," but was truer to the Spirit of the Master, and was an exemplar of tolerance and kindness. But the poet and artist, William Blake, who with his wife and about a dozen others (among them James Glen who first carried the teachings of Swedenborg to America) founded the first New-Church society in London, two years afterwards repudiated its principles and followed Priestley's teachings. In thus abandoning his earlier impulses, and in cruelly maligning his friend and benefactor and brother-artist, Flaxman, who remained a consistent New-Churchman, Blake seems to me to have profaned sacred things. Priestley opposed but did not profane the sacred things, because he never understood them.

I have answered the challenge of atheistical science in *The Helper*, for February 13, 1924 (published at Philadelphia) under the title "A Sifting of the Souls of Men"; and I have answered the misrepresentations of spiritistic Arianism in a paper, "The Rejection of the Lord," which has been sent to the same publication but has not yet appeared.

CHAPTER XIII

CORRESPONDENCES

SWEDENBORG's first conception of his doctrine of correspondences came to him during his study of the human body, that royal kingdom of the soul, of which we read in his *Œconomia Regnis Animalis*, the Economy of the Soul's Kingdom. In Clissold's translation, n. 633, after a preliminary statement of the "doctrine of series and degrees" at the opening of Vol. II, we are told that "The most simple and the only substance of the animal kingdom is the spirituous fluid; which is most perfectly determined by the first aura of the world; whence it obtains such a nature, as to be a substance capable of forming its own body; and to have in it life and consequently soul, which is the principle of the things existing in the whole of that series."

In order that there may be a *series*, there must be a mode of joining and correlating the parts and a conjunction by intermediates. "For if," says Swedenborg, "the state proper to the soul be called a moral state, in which is found the beginning of reason or the principle from which reason originates; and if the state proper to the intellectual mind [*mens*] be called a rational state, in which is found the beginning of affections and impulsive causes, or the principle from which these originate; and if the state proper to the external mind [*animus*] be called a physical state, in which are found affections as the impulsive causes of the actions of the body; and if the state proper of the body be called a mechanical state; it then follows that there can be no influx from the moral state into the mechanical state of the body, except by the rational state and thence by the physical, or by two intermediates, and this also,

for the most part, not by direct determination, but by a mode of concurrence or consent; by reason that the powers and faculties are distinct, whence results liberty; according also to the rule in n. 648 [*If we would explore the efficient, rational, and principal causes of the operations and effects existing in the animal body, it will be necessary first to inquire what things, in a superior degree, correspond to those which are in an inferior degree, and by what name they are to be called?*], connection is requisite, whence result dependence and mutual relation. . . . Consequently, there can be no such thing as Pre-established Harmony. . . . Thus there is Co-established Harmony. *To actions correspond forces [vires]; to forces potencies [potentiæ]; to potencies, in the supreme degree, the force of forces, that which is principally the living force, which in an animal is life.*" (n. 648.)

This definition of correspondence concerns discrete degrees of action and their connection, rather than that correlation of spiritual and natural phenomena which is meant by the term in its later use by Swedenborg. A nearer approach to the final form of the principle is that given in "A Hieroglyphic Key to Natural and Spiritual Arcana by Way of Representations and Correspondences." (N. 9, p. 162, of Acton's translation in "Psychological Transactions," Swedenborg Scientific Association, Philadelphia, 1920.)

Rules. 1. There are two modes of proof whereby we may know whether we have reached the truth. Whether or not it is a physical truth in the first class is apparent from the second and third, or the moral and theological classes; and whether or not it is a moral truth is apparent from the physical and theological classes. All things should conspire together and be in concord, that is, should confirm the real truth; for when there is a correspondence, if something be met with that is not true, it is a sign of error.

2. There is, in addition, another proof, to wit, when the contents of the three classes are so concordant that when placed

side by side they produce a fourth truth. As in the present case. *In order that the representative world may be perfect, the providence of God, the wills and ends of minds, and the conatuses and effects of nature must be consentient.* Thus the one is an exemplar, the other a type, and the third a likeness. All things Divine are exemplars, things intellectual, moral, and civil are types and images, while things natural and physical are likenesses. Thus exemplars, types, and likenesses must by a mutual correspondence represent each other. There is also a mutual correspondence and harmony; for one is recognized by the other, and one recognizes the other as the respective of itself.

This citation is taken from the explanatory "rules" appended to twenty-one illustrative examples (in this case the 2nd) in which the principle is applied, to show the connection between the three fundamentals—God, man, and nature. *Example I* follows:

In every nature there is, implanted in its conatus, a principle of effecting something; therefore, as is this principle, such is the faculty of effecting it; as the faculty, such is the conatus; and as the conatus, such is the motion, and consequently such is the effect.

There is in every human mind, implanted in its will, an intuition and love of some end; therefore as is the love, such is the desire; as is the desire, such is the benevolence and will; and as the will, such is the action, and consequently such the accomplishment of the end.

There is in God, implanted in His providence, a most pure love towards us and for our salvation which is the end of creation; therefore as is this love, such is His grace and providence; and as is the providence, such the operation, and such our salvation which is the end of all ends. (n. 5.)

There follows a list of "expressions which mutually correspond to each other in this case," but at the end of the "key" is given an "Index of Correspondences," extending to 9 pages.

Correspondences in "Example II."

1. PRINCIPLE OF EFFECTING, INTUITION OF AN END, AND, IN GOD, THE LOVE OF THE END OF CREATION, THAT IS, OF OUR SALVA-

TION. At first sight it seems as though something else [other] than love, in God, would correspond to the principle of effecting in nature; but because God is the beginning and end of all things, there can be no beginning, or that which is himself, in God. But there can be a beginning in His providence, since providence is operative; and this beginning can be no other than His most pure love toward man for man's salvation which is the end of creation.

2. EFFECT, END, END OF ENDS, OR THE SALVATION OF SOULS. Effect pertains to nature, but end to the human mind; for minds view ends before effects, and afterwards effects as instrumental causes which promote the end. It is but faintly human to conclude the end from the effect, that is, to gather wisdom from the mere presence of things, and beyond this to judge nothing concerning things yet to be. But in human minds it is only particular ends that are regarded, while the end of ends, or the most universal of all, belongs to God himself. This end must be described in order that one may understand what it is, namely the heavenly society of souls, that is, the salvation of the human race.

3. FACULTY, BENEVOLENCE, GRACE. It is well known that benevolence pertains to man and grace to God. But what must we assume as the correspondent in nature? There can be no doubt but that it is a greater or lesser faculty, proclivity, or proneness, of bringing into effect, that is to say, a greater or lesser facility—from which indeed the word faculty is derived, a word which in other connections signifies power, possibility, etc. (*Ibid.*, n. 7.)

These things he confirms from the writings of various philosophers, as well as from his own thought. Indeed, it is evident that in the ordinary growth of language, the formation of words to express human and spiritual principles has been greatly facilitated by an intuitive recognition of a similarity (correspondence) between certain physical processes and those mental phenomena for which it was desired to find a name. The origin of figurative language and metaphor is the beginning of an attempt to formulate correspondences. Origen and the early Christian fathers tried to discover an underlying symbolic

meaning in the Sacred Scriptures, but were seldom successful in getting any but the crudest result. They lacked a perception of the "key." Indeed, these early efforts of Swedenborg are in several instances marred by errors in his physical theories. For instance, his fantastic theory of color, and his doctrine of the composite nature of the red-blood corpuscles, founded on a poor observation by Leeuwenhoek, reappear in his correspondences, which, to this extent, are imperfect and require restatement. Leeuwenhoek's theory of the blood corpuscles was refuted by Lancisi, who is quoted by Swedenborg, but in the controversy between these early observers, Swedenborg unfortunately pinned his faith on the wrong man. For his color hallucinations, he is himself responsible. In Chapter VIII, 16, I have shown how disastrous is his mistake to a genuine correspondence.

One of the twenty-one examples of the "Key," the fifth, introduces some puzzling and debatable questions, both in spiritual philosophy and in natural science. In fact, Swedenborg decides that in this case one of his three fundamentals must necessarily be omitted. I will quote this example in full:

"EXAMPLE V." n. 17. The force of inertia and passive force is the principle of gravity and the cause of rest in the substances of the world.

Sluggishness and indifference is the principle of indetermination and the cause of inaction in the human body.

N. 18. *Correspondences*. 1. THE FORCE OF INERTIA AND SLUGGISHNESS. In the animal kingdom there is nothing that corresponds to the force of inertia except sluggishness; otherwise it would be torpor, cold, or death; but the subject here is correspondence with the LIVING animal. 2. PASSIVE FORCE and INDIFFERENCE, that is to say, not being moved, or not suffering oneself to be aroused to reaction as is the nature of passive force. 3. GRAVITY and INDETERMINATION. REST and INACTION.

N. 19. *Confirmation of the propositions*. 1. The force of inertia is not a dead force, but it exists when a body is deprived of the

force of reacting in the same ratio as it is acted upon, that is, is deprived of its elastic power. Thus the impressed force is absorbed, since that body does not then give back as much as it receives. 2. Such is the nature of corpuscles of the angular form; for in such corpuscles all the least points become quiescent, that is, they enjoy no force or conatus of action,—this being due to a certain perpetual resistance and collision in their least constituents. Hence it follows that in such corpuscles there is gravity, rest, cold, and the like, which are purely terrestrial predicates. 3. Such a perpetual opposition and contrary direction sometimes exists also in human minds, whence comes indetermination and inaction; this arises also from sluggishness and indifference which absorb the forces as though the subjects were devoid of sensation.

N. 20. *Rules.* One of the classes may be wanting, owing to there being no corresponding representative; as in the present case; for in things divine there is nothing corresponding to sluggishness, inertia, gravity, rest, indetermination, inaction; for properties that pertain rather to death are not predicable of pure and veriest life.

Passing over some confusion of thought which identifies inertia with absence of elasticity and some minor points to which objection might be taken, let us consider first what actual inertia is, and whether it may not enter into some relations which correspond with Divine things. Some of the questions involved in the subject I have treated many years ago in *The New Christianity* and elsewhere, and I will quote a portion of this, without pretending to have settled questions which deserve a much more extensive study.

It is a fundamental concept of physics, that all matter is inert; that is, matter cannot change its state, either of motion or of rest, without the intervention of an extraneous force. Thus the planets, being endowed with a certain amount of momentum, would move in rectilinear paths and would recede from the central luminary, if they were not continually deflected by the attraction of the central mass. This sunward-drawing force keeps the independent tendencies of the component members of

the sun's family in check. While the attraction does not destroy the individual motions, it guides them into the beautiful curves whose properties and variations form the subject of the study called "celestial mechanics."

Professor Ferrel, in his "Popular Treatise on the Winds," says:

"This tendency of a body, in gyrating around a center, to recede from the center, and when not free to depart, to cause pressure in the direction of the radius from the center is called *centrifugal force*. It must be understood, however, that this so-called force is not a real force, such as arises from any attracting or propelling force in a given direction, but simply that the gyrating body, if free, would at any given instant be carried away from the center by its inertia in the varying direction of the radius, in the same manner as it would be moved in a given direction by the action of a constant and real force in this direction. The centrifugal force depends simply upon the inertia of the body, and being always at right angles to the direction of the gyratory motion, it does not increase velocity and momentum, as a real force does, but tends simply to drive a body away from the center of curvature, and to cause pressure in that direction."

This logically exact definition, formulated by a great mathematician, will serve as a basis for a spiritual lesson.

The power of evil is a power of denial, seeking to abrogate the Divine Laws, opposing the attracting force of the Divine Love, which draws all things to itself;—and yet, in and of itself, evil has no power. All appearances to the contrary are but semblances.

Evil is man's spiritual inertia, without which there could be no existence separate from the Divine, any more than the planets could be maintained in their orbits without physical inertia which prevents their falling into the sun. Unless circumscribed by barriers, the soul being in its essence Divine, could not be confined, but would return to its home in the Divine world, whither it ever tends; but that it may fulfill its mission, it is put in the bonds of *proprium*—that which is proper to the merely human, distinguishing the human from the Divine. That which separates us from God is necessarily evil, and the finiting principle is self-love, the opposite pole to Deity—a temporary

and temporal necessity, but not, to the perfecting soul, an eternal one, as angel-man well knows. Yet, in one sense, the evil of self-love is eternal, and hell itself performs a perpetual use in the Divine economy by serving as a basis for reaction, without which there can be no power.

Without the power which comes from evils met and conquered, the purest, most angelic being would be a thing of weakness. Yea, even the Divine could not enter into the fullness of power to redeem angels, men, and devils from sin, until, in the person of the Savior, Jesus Christ, the universal hells had been met and conquered.

Herein lies the seeming power of evil, that it can oppose Divine Good; yet it cannot alter Divine Providence, which overrules all evil for good.

That which is in good, and at the same time in truth, is something; and that which is in evil, and at the same time in falsity, is not anything. By its not being anything, is meant that it has no power and no spiritual life. Those who are in evil, and at the same time in falsity, who are all in hell, have indeed power with one another; for one who is in evil can do evil, and he also does it in a thousand ways (nevertheless, he can do evil to the evil only from [their] evil); but he cannot harm the good in the least, except, as is sometimes done, by a conjunction with their evil, whence come temptations, which are infestations by the evil who are with them, and the combats thence arising, whereby the good can be freed from their evils. Since the evil have no power, all hell before the Lord is not only as nothing, but is absolutely nothing in power. (*Angelic Wisdom concerning the Divine Providence*, n. 19.)

In fact, the sway of evil is perfectly represented by that physical centrifugal tendency which "is not a real force," and does not increase velocity and momentum as a real force does, but tends simply to drive a body away from the center." Evil cannot make, but only mar; and its destructions are utilized for the stripping of the soul's non-essentials.

Nothing real is ever lost. Every grave has its resurrection. The sea gives up its dead, and death and hell give up the dead that are in them. There is nothing of man that doth fade,—

"But doth suffer a sea-change
Into something rich and strange."

What becomes of apparently wasted effort? Is there not some law of the spiritual "conservation of energy"? Oh, yes, there is surely such a law, making for the perpetual stability of the spiritual universe. "As the rain cometh down and the snow from heaven and returneth not thither, but watereth the earth, and maketh it bring forth and bud, and giveth seed to the sower and bread to the eater, so shall My word be which goeth forth out of My mouth; it shall not return unto Me void, but it shall accomplish that which I please, and it shall prosper in the thing whereto I sent it." (Isaiah lv., 10, 11.)

The impulses of brotherly love may be hidden; the instructions of spiritual lessons may seem to leave no mark on the thoughtless hearer, even as the sun's rays shining on a block of ice do not at first heat it but are used up in the preliminary work of melting its stony hardness. We say the heat imparted becomes latent. It disappears as sensible heat, but persists as imperceptible internal motion. Just so there is an immense amount of internal work in the saving of a human soul of which we take no account. Only the Lord and His helping angels know of the internal rearrangements and revolutions which prepare the way for the new birth, even while we are "under the fig-tree." The flower-bud in its dull green, horny encasements gives little promise of future beauty. But within is the germ of every floral organ that shall be, tenderly enswathed in protective wrappings. One day comes the right adjustment of warmth, moisture, and sunshine, and lo a marvel! The flower has blossomed; and rich tints of pink and purple gauze, and crowns of golden ornaments encircle a little ark, rich with the promise of futurity.*

The interior hidden things belong peculiarly to the Lord and as latent heat is essential to certain physical transformations, so we learn that "unless man is furnished with truths and goods, he cannot be regenerated. . . . These truths and goods are the remains which are reserved by the Lord for such uses." (*Arcana*, n. 711.)

* "Spiritual Inertia," F. W. Very in the *New Christianity* for March, 1893.

As to *remains*, they are not only the goods and truths which a man has learned from the Lord's Word from childhood up . . . but they are also all the states derived thence; such as states of innocence . . . states of love towards parents, etc. . . . states of charity towards the neighbor, and also of pity for the poor . . . in a word, all states of good and truth. These states, with the goods and truths impressed on the memory, are called *remains*; which are preserved in man by the Lord and stored up, quite without his knowledge, in the internal man; and are separated well from the things proper to man. (*Ibid.*, n. 561.)

Similarly, inertia may be likened to man's proprium which is a gift from God without which man could not have either individuality or freedom. Taken by itself, the proprium is a thing of no power, and yet, like the inertia of the planets which "does not increase velocity and momentum as a real force does," the planets are preserved from falling into the sun by means of this nonentity. It seems that there is an important place for inertia in the scheme of things. Has there really been any omission of the usual third fundamental in Swedenborg's "example V"? How about the hidden things of the Lord's Mercy? The apparent withdrawal of Himself in order to leave man in freedom is not incompatible with a most potent control. How about the wise provision that man by his *inaction* shall not interfere with the beating of his heart or the essential non-control of the vital functions by the man himself, in order that he may commit himself to the care of One wiser than he? Even the angels must not interfere with the deepest things of the Divine Providence. Some things must be veiled.

When Swedenborg began his great work as seer and revelator, then all his previous attainments as a natural scientist were seen to have been simply preliminary to a far greater spiritual science to which the science of correspondences gave entrance. For this purpose the science of the "Hieroglyphic Key" left much to be desired. We must pass to his greatest work, the

Heavenly Arcana, in which, as "Servant of the Lord Jesus Christ," he received his commission to open the gates of Heaven, and his further memorable commission to unlock the treasures of the Book "sealed with seven seals" which only "The Lion of the Tribe of Judah" could unfold. Here a more searching treatment than that of his early "Key" was needed. Accordingly we read in *Heaven and Hell*:

First, what correspondence is. The whole natural world corresponds to the spiritual world, and not merely the natural world in general, but also every particular of it; and as a consequence everything in the natural world that springs from the spiritual world is called a correspondent. It must be understood that the natural world springs from and has permanent existence from the spiritual world, precisely like an effect from its effecting cause. All that is spread out under the sun and that receives heat and light from the sun is what is called the natural world; and all things that derive their subsistence therefrom belong to that world. But the spiritual world is heaven; and all things in the heavens belong to that world. (*Loc. cit.*, n. 89.)

The spiritual world is not understood without a knowledge of correspondences. (n. 88.) A knowledge of correspondences is necessary to an understanding of the change of natural into spiritual delights. (n. 487.)

The Egyptians and other Eastern nations had a knowledge of correspondences. (n. 87.) All knowledge of correspondence must come from heaven. (n. 110.)

Consequently it is not enough to guess at these things from a knowledge of nature alone. Nevertheless much confirmation of the doctrine of correspondences, now revealed from Heaven, can be obtained through a careful application of scientific principles, treating them in the way which Swedenborg has made known. I will give two illustrative examples of such study, one of which makes use of extracts from articles by me in the *New Christianity* and *New Church Review*, without further acknowledgement.

A true correspondence is not a mere generalization, but has its fulfilment in the minutest details. The greater the knowledge of the structure, order, and relation of parts, and of the meaning of these details, the more wonderful is the exhibition of the spiritual principles involved in the correspondence. Therefore the conscientious study of minute details in science, even if no immediately practical result appears, should not be discouraged. It is necessary that these great Egyptian granaries shall be filled to repletion. In the time of spiritual famine they will find their uses.

By scientific truth is understood everything scientific by which spiritual truth is confirmed and which has life from spiritual good; for man by scientifics may be wise, and he may be insane; he becomes wise by scientifics when he confirms by them the truths and goods of the church, which are spiritual truths and goods; but he becomes insane by scientifics when he uses them to invalidate and refute the truths and goods of the church. When the truths and goods of the church are thereby confirmed, they are then called scientific truths and also are said to be living or alive; but when the truths and goods of the church are thereby invalidated and refuted, they are then called scientific falses, and also dead. (*Apocalypse Explained*, n. 507.)

Scientific truths are necessarily limited and they should be subservient to spiritual truths. They are stepping stones at the entrance of a beautiful palace, to be trodden under foot before we can come into the larger glories within. It is a scientific truth that the light of the sun, entering a healthy human eye, produces sight; but it is a spiritual truth that all sight is of the spirit which flows down into the body by paths which the grosser impetus from without has opened. The union of these two truths gives a rational explanation of the sense of sight and confirms the teaching of the church that there is a more interior sight than that of the body. The denial of the spiritual truth, and the assertion that sight is a physico-chemical action of the body alone, closes the spiritual eye, or the understanding, and

bars the way to the perception of a multitude of spiritual harmonies in nature, while it involves the false doctrine that sight, the life of the eye, perishes with the destruction of the envelope of flesh; and the soul, with its immortal life, becomes a myth.

Science exists for the sake of higher things, for the sake of inventions and uses whereby the Lord's kingdom may be established on the earth, and for the sake of heavenly knowledges in man which rest upon scientifics. "Truth itself, considered in itself, is spiritual, and in the spiritual man makes one with the affection of truth, for it is the form of the affection of the spiritual man; so far, therefore, as this affection, with its form, is thence in the scientifics which are in the natural man, so far the scientifics contain in themselves truths and are scientific truths; for the scientifics of the natural man, viewed in themselves, are not truths, but only the containing vessels of truth, wherefore scientifics are also signified by vessels in the Word." (*Ibid.*, n. 511.)

The sea signifies, in spiritual language, the natural man; and its living creatures, or fishes, scientifics. "This signification is also grounded in correspondences, for the spirits who are not in spiritual truths, but only in natural truths, which are scientifics, appear in the spiritual world in seas, and when viewed by those who are above, as fishes; their thoughts, which proceed from the scientifics with them, being what thus appear. For the ideas of the thoughts of angels and spirits are turned into various representatives out of them. . . . The ideas of the thought of those who are natural, and think from scientifics alone, are turned into forms like fishes." (*Ibid.*, n 513.)

This recalls the Eastern tale where the Sultan, seeking the cause of a mysterious lake and its colored fish, finds the young king of the Black Isles—half marble and half man—and learns the story of his cruel queen, who, enraged at the loss of her black paramour, for whose illicit love she had dishonored

a kind husband, condemns the latter to a living death, and transforms his people into fish by her magic, and their city into a lake.

If the heart's affection turns towards evil, darkness is preferred to light; the living truths of the spirit can no longer invigorate the lower parts of the mind, which become then of stony hardness; the feet no more run on works of love; the memory, which should be a populous, busy city, filled with merchandise from many lands, and with eager servitors ready to do the bidding of its ruler, is turned into a lake of water; and its inhabitants, or thoughts, no longer breathing the higher air of heavenly uses, become transformed into fish at the whim of an enchantress; for, if the heart's love be evil, the thoughts look not up to heaven,—erect, upright with human virtue. They have become beast-like. Pray that the sword of truth, the king's own sword, may smite the enchantress and deliver the young prince of the Black Isles!

The general significance of fishes is derived from the medium inhabited. Truths held only in the memory are of a lower order than truths which enter the understanding and are applied to use, even as the life of the sea is of a lower order than that of the land. When thus contrasted, water is natural truth, air spiritual truth, and the life of the sea, representing the natural, is less highly organized, or less vitalized, than that of the land, representing the spiritual man.

Let us next study details. The limbs, in fishes reduced to small pectoral and pelvic fins, are feeble and only serve for balancing. Scientifics by themselves have no power to effect uses of a higher order. It is only when taken in hand by philosophical principles and used as materials for broad generalizations that they serve higher ends than those of mere statistics. Fishes do not climb, but they become the food of bird and beast, thus nourishing a higher life by their death.

The motive power in the fish is not found in arms or legs, but in an enormously developed tail, the larger part of the fleshy body consisting of great slabs of muscle for moving the terminal propeller.

The life of the sea is, as a rule, of a lower order than that of the land. The animals are decephalized,—that is, less concentrated headwards, the brain small in proportion to the size of the body, the powers of locomotion often limited, some forms even approaching the vegetable in many ways. The plants also of the sea are cryptogamous, not seed-bearing, and of simple structure; and regarded from the point of view of use, beauty, or structural specialization, they must yield the palm to the more varied, useful, and beautiful adornments of the land.

Fishes are no exception to the general rule of the inferiority of the life of the sea. The brain is small. The limbs, which have become fins, are no longer used for walking, but merely serve to balance the animal, the main power of the creature residing in the tail, which is enormously developed, its powerful muscles constituting a large part of the bulk of the animal. It is the tail, or rather the muscles for its motion, which form the edible part of the fish; and a further reason for the correspondence of fishes, as well as for their wonderful adaptation to the medium in which they reside, may be deduced from a study of this predominant feature in their anatomical structure.

The reason why tails signify sensual scientifics, is, because the tails which are attached to the animals of the earth are continuations of the spine of the back, which is called the spinal marrow, and this is the continuation of the brain, and by the brain are signified intelligence and wisdom, in like manner as by the head, because intelligence and wisdom reside there in their principles or beginnings; and inasmuch as tails are the ultimates thereof, they signify sensual scientifics, for these are the ultimates of intelligence and wisdom. Sensual scientifics

are those which enter from the world through the five senses of the body, and hence, viewed in themselves, are more material, corporeal, and worldly, than those which are more interior. All who are in the love of self, and have confirmed themselves against divine and spiritual things, are sensual men; and when they think in their spirit, as is the case when they are left to themselves, they think concerning things divine and spiritual from sensual scientifics, whence they reject things that are divine and spiritual as not to be believed because they do not see them with their eyes or touch them with their hands, and apply their own scientifics, which they have made sensual and material, to destroy them. Take, for example, the learned men of this kind who are skilled in natural history, anatomy, botany, and the other branches of human erudition. When such persons see the wonderful things that exist in the animal and vegetable kingdoms, they say in their hearts that all these things are from nature, and not from the divine being or principle; and for this reason—because they believe in nothing but what they can see with their eyes and touch with their hands; for they cannot elevate their minds and thereby see those things from the light of heaven, for the light is mere darkness to them, but they detain their minds in things terrestrial, almost like the animals of the earth, with which they also compare themselves; in a word, with such persons, all the sciences become sensual; for according to the quality of the man himself, such are all things pertaining to his understanding and will. If the man is spiritual, all things become spiritual to him; if he is only natural, all things become natural and not spiritual; if he is sensual, all things become sensual, and this, however erudite and learned he may appear before the world; but since all men have the faculty of understanding truths and perceiving goods, they can speak by virtue of this faculty, as if they were spiritual-rational, but still they are sensual as to the spirit, for when such speak before the world, they do not speak from the spirit, but from the memory pertaining to the body. These observations are adduced in order that it may be known what sensual scientifics are. (*Ibid.*, n. 559.)

Both things of the sense impressions and the scientifics formed from them have their uses; and these uses are im-

portant, since they lie at the foundation of all our knowledge, and all knowledge, to be stable, must rest on experience. It is a mistake, however, to suppose that the experience has formed or constitutes the real knowledge. Only when the experience is valued as crude ore to be worked over and its precious metal extracted, does it fulfill its purpose. Scientifics are "only the containing vessels of truth," and this is true even of those vessels which contain holy things. "By scientifics from the Word are understood all things of the literal sense thereof, in which there does not appear anything doctrinal." (*Ibid.*, n. 545.)

There are different orders of scientifics, but all have their abiding place in the memory, as memory knowledges (to be distinguished from cognitions—the things of the understanding).

When it is known that there is both an internal and an external man, and that truths and goods descend by influx from or through the internal man to the external from the Lord, although this is contrary to appearance, then those things, or the knowledges of the true and the good in the regenerate man, whether it be natural, spiritual, or celestial, abide there as a scientific and are called forth thence by the Lord. (*Heavenly Arcana*, n. 27.)

Jesus said to them, "Cast the net on the right side of the ship, and ye shall find." They cast, therefore, and now they were not able to draw it for the multitude of fishes. (John xxi, 6.)

This is the true end of all scientifics, to be drawn forth from the love of what is good (the right side), and used in the multiplication of the genuine knowledges of truth.

Observe how perfectly the details harmonize with the general signification of the fish, and the spiritual necessity that this inhabitant of a watery medium should have tail-power. The corresponding mechanical necessity has evolved the screw-propeller of the ocean steamship.

The median fins of a fish are provided with a great many

ony rays articulating with the interspinal bones, but all of this paraphernalia is a dermal appendage; and the same is true of the covering of scales which in many cases constitutes a veritable bony armor, or external skeleton, protecting against injury from outward attack. Hard facts, these, in their spiritual analogy. Many members of the group have an extraordinary tenacity of life and an apparent insensibility to pain. "Facts are stubborn things," you know. The scales are superficial or sensuous truths, apparent facts, often misleading. They will rub off very easily. Often, however, this external covering is gorgeously colored.

In beauty, variety, and changeability, the colors of fishes cannot be exceeded by those of any other of the vertebrate classes; metallic tints and almost all the colors of the rainbow being very commonly displayed. (The Royal Natural History, Vol. V, p. 320.)

This is especially the case with those which live among brilliantly colored corals and seaweeds, where the color has no doubt a protective influence. Sensuous appearances are often very attractive, whatever be the end for which they are sought. Those who are investigating and endeavoring to discover laws, must have an abundance of scientific facts with which to test their hypotheses; and to such investigators facts are beautiful things indeed, their beauty being enhanced by their use, or by the end in view which is the attainment of higher truth. These pleasant fields of memory, stored with scientifics, are also represented in the "Heavenly Arcana" (n. 9394), "as plains full of herbs, flowers, and every kind of shrub and tree; or as gardens adorned with various things for uses and delights," whence the life's affection plucks such things as agree with its principles.

Recent deep-sea exploration has made known many bizarre forms of life, inhabiting a world of darkness, lit by luminous

organs developed in the bodies of these strange and often hideous shapes; and almost simultaneously there has arisen a body of semi-scientific fact of a somewhat uncanny nature on the borders of that department of psychology which adjoins the night side of life. I think we may see a correspondence here in these mutterings from the abyss.

Fishes are often exceedingly prolific; and in like manner every new scientific fact opens the door to a host of further details, and suggests new experiments and extensions of knowledge. The dictionary is always expanding.

So we might go on, asking why a fish is cold-blooded, the circulation and aeration of the blood deficient, the heart of two cells, or only half a heart as compared with that of the warm-blooded mammalian, why the fish has so little affection for its offspring, why so many bones, and so on. In every case we shall find that the answers from spiritual principles fit exactly into the general significance. To those who love to think from philosophical principles, or to consider ends and uses in all they do, great accumulations of statistics are very wearisome, uninteresting, and lifeless things. Statistics remain disconnected, if unattached to a unifying principle, until, sifted, classified, and embodied in doctrines by the help of nobler principles, they support each other. It is well for the child to commit to memory lists of names, and to make collections of specimens as raw material for future work, but it is not well to acquire the life passions of an intellectual miser by dwelling continually in these things, and one who has passed beyond them will never ask to go back. It is instructive that while many animals begin life in the water, and afterwards become air-breathing, there is no instance of the reverse process. Thus all life tends to progress upwards. It tells us that we shall not have to go back and live in animal forms as the reincarnationists would have us believe. (See *Heaven and Hell*, n. 256.)

My second example treats of

NUMBER AND MEASURE

The Word of God is continually speaking of numbers—numbers of days and years, of people, of their ages, of the dimensions of objects, standards of linear and cubic measure, of money, etc.

These dimensions and quantities, in their literal meaning, are wholly physical, wholly relating to time and space. The sceptic may well ask: Why is so much importance attached to trivial details? What difference would it have made if the Ark of the Covenant had been a few inches longer or shorter? He might be willing to admit that the birth of a child to Abraham when he was 100 years old and his wife 90 years old, was so extraordinary an event that it is worth recording *as a natural phenomenon*, but he asks: Why should these things appear so continually in a book which purports to be our guide in the life of religion? What have they to do with religion?

And Swedenborg gives the answer—or rather, the Lord, through His servant Swedenborg, gives us the answer. There is no number and no fact, given in the Holy Word, however seemingly trivial it may appear, but has a profound spiritual signification. It could not have been different. This connection between spiritual and natural things is, indeed, *revealed*, but still it is capable of rational confirmation, for correspondences are a part of a genuine spiritual science, resting on experience and amenable to laws.

Swedenborg shows us that the lives of Abraham and his wife Sarah were wonderfully guided under Divine Providence, so that they could represent and foretell by an arcane symbolism, fully understood by the angels, what were the states through which Jesus had to pass when He was a little child. This was all provided from the beginning by Divine Omnipotence and foretold by Divine Omniscience.

In Genesis xvii, 1, we read: "And Abram was a son of ninety years and nine years; and Jehovah appeared to Abram and said to him, I am God Shaddai; walk thou before Me, and be perfect."

The reason these things happened when Abraham was 99 years old is given in the "Heavenly Arcana," n. 1988:

Abram was a son of ninety years and nine years. That this signifies the time before the Lord fully conjoined the internal man with the rational, is evident from the signification of nine as coming before ten; or what is the same, of ninety-nine as coming before a hundred; for Abram was a hundred years old when Isaac was born to him. The nature of the internal sense of the Word may be eminently manifest from numbers, as well as from names. The numbers in the Word, whatever they are, signify real things, as do the names also; for there is nothing at all in the Word in which the Divine is not, or which has not an internal sense; and how remote this is from the sense of the letter is especially manifest from the numbers and the names; for in heaven no attention is given to these, but to the things which are signified by them. For example, whenever the number seven occurs, instead of seven there at once comes to the angels the idea of what is holy; for seven signifies holy, because the celestial man is the seventh day, or the Sabbath, and thus the Lord's rest. . . . It is similar with other numbers, as, for example with twelve. Whenever twelve occurs, there comes to the angels the idea of all the things of faith; for the reason that these were signified by the twelve tribes. . . . So it is with the number ninety-nine; and that it signifies the time before the Lord fully conjoined the internal man with the rational, is evident from the signification of a hundred years, which was Abram's age when Isaac was born to him; for by Isaac is represented and signified the Lord's rational man that is conjoined to His internal man, that is, to the Divine. By a hundred is signified the same in the Word as by ten; and ten signifies remains. . . . These arcana cannot be set forth further, but every one may come to some conclusions when he has made himself acquainted with what remains are; for what they are, is at this day unknown; only let it be known that remains in the Lord signify

the Divine goods which He procured to Himself by His own power, by means of which He united the Human Essence to the Divine Essence. From this it may be evident what is signified by ninety-nine; for this number, because it precedes one hundred, signifies the time before the Lord fully conjoined the internal man with the rational. The first rational in the Lord was represented by Ishmael; . . . but by Isaac is represented the Lord's Divine rational, as will be evident in what follows. From Abram's staying so long in the land of Canaan, now twenty-four years, ten years before Ishmael was born, and thirteen years after that, without his having a son from his wife Sarai, and from the promise of a son being first given when he was ninety-nine years old, everyone can see that an arcanum is involved. The arcanum was, that he might represent thereby the union of the Lord's Divine Essence with His Human Essence; and indeed, the union of His internal man, which is Jehovah, with His rational.

Much more could be given, if we were to look up all the references.

We might approach the subject in another way, seeing that 99 is made up of 11 nines, and that 12 denotes what is perfect as to the things of faith, eleven, which comes before 12, signifies an approaching perfection which is still incomplete. At twelve years, Jesus was ready to go into the temple and talk with the rabbi. The significance here is in the *number*. Twelve signifies complete preparation in the things of faith—one hundred equals the completed storing up of Divine Celestial remains in the child Jesus.

In the book of the Apocalypse we read of the Holy City:

And the city lieth four square, and the length thereof is as great as the breadth. (xxi, 16.) On the east were three gates; and on the north three gates; and on the south three gates; and on the west three gates. (xxi, 13.) And he measured the wall thereof, a hundred and forty and four cubits, the measure of a man, which is that of the angel. (xxi, 17.)

And of a dire menace to that fast approaching new dispensation, we read (xiii, 18):

Here is wisdom. He that hath understanding let him count the number of the beast, for it is the number of a man; and his number is six hundred and sixty and six.

Let us consider the meaning of these numbers.

The foursquare city says, almost in so many words: Let performance equal promise. Let your good deeds match your asseverations of belief. Heavenly doctrines demand genuine good of life.

In general, the number one signifies knowledge of the one only God, Jehovah-Jesus. The palm tree with its single trunk pointing straight up to the sky and with no branches to distract the attention, typifies that knowledge and acknowledgment, that God is one in essence and person. That triumphal entry into Jerusalem, when the people went out to meet Him with palms in their hands, spiritually represented this acknowledgment that Jesus is the God-Man.

The number two signifies conjunction, union through love, witnessed throughout nature from the chemical affinity of the atoms to the loves of the plants and the beasts up to man.

Three signifies what is complete as to truth. The triangle is the plane surface with the fewest possible number of sides. The trine is inevitable: In God, in nature, in man, in everything. Soul, body, and active life from their conjunction. Nothing could exist without these three.

The number $4 = 2^2$ signifies love to the uttermost, interior conjunction, what is complete as to good. The solid figure which can be enclosed by the smallest possible number of plane faces is the three-sided pyramid with triangular base, or tetrahedron, having four equal faces and four angles. Truth (3) even when complete, is the superficial appearance of a thing. Good (4) is solid substance.

Seven, made up of $4 + 3$, signifies the complete inseparable

union in the Divine of Love and Wisdom—hence what is holy. It cannot be factored.

The product $4 \times 3 = 12$, signifies the less perfect union of good and truth in the faith of the Church, or of the man of the Church, perfect as far as the finite can approach perfection, but not joined in the indissoluble union of the Divine perfection. It can be factored, and in several ways. Thus $12 = 2 \times 6$ tells us that the conjunction of good and truth in human lives is not accomplished save by temptations met and conquered. The four sides of the city are the four different kinds of good life to which the four Gospels are addressed.

Six is the half of twelve, therefore only half a man. In an evil sense, six being one less than seven, signifies profanation and in a lesser degree, temptation. Six days of labor are the necessary trials of life, but these are of no avail unless they lead to the Sabbath of rest from evil and to holiness.

Three sixes are the fulness of profanation, or the Dragon with his seven heads:

1. The vicarious atonement.
2. Salvation by faith alone.
3. Imputation of the merit of Christ.
4. Three persons in the deity.
5. The resurrection of the body.
6. An eternal hell of fire.
7. Predestination to either heaven or hell.

Every one of them a denial of an essential Divine Doctrine.

Michael Servetus, the first New Churchman, in a way, that is to say, the first who believed in our fundamental doctrine that the Lord Jesus Christ is the only God, was burned at the stake for this belief by Calvin, the assiduous preacher of predestination, who taught that there are infants in hell. Swedenborg teaches that all who die in infancy and childhood, go at once to heaven. Also that the Lord predestines all for

heaven. Also that it would be impossible for God to condemn anyone to an eternity of suffering for the sins of so short a life.

The doctrine of salvation by faith alone without works, solely by the imputation of Christ's merit, was "made in Germany," where it went to seed and culminated in the war to secure rule over all the world: "Deutschland über Alles"—truly the Dragon's war, with its deliberately organized cruelties, world-wide propaganda of deceit, perversion of the knowledges of truth, science corrupted and turned to evil ends, the stars of heaven dragged down to hell. It is perhaps not without significance that the Kaiser* (who by a word could have prevented the slaughter) was just 666 months old when he decreed that the World War should begin. But apart from such cabalistic interpretations, 666 stands for beast-man and his ways, the 144,000 for angel-man. And Michael prevailed!

History is continually repeating itself. The allusion just made belongs to one of the internal historical applications of the text. What was its original historical application? Read Professor Wunsch's thrilling account (in the *New Church Review* for January, 1923)† of the heartening and inspiring effect which the Apocalyptic message from the beloved John in exile must have had on the persecuted Christians of the seven churches which were in Asia. While this book of the Word has its special application to our own age, it also had a message

* It must be understood that this does not refer to the personal character of the Kaiser, which we do not and cannot judge. The reference is to his historic position and that of the German people as the special exemplification of the result of that long preparation which brought on this seedtime of the Dragonistic principles, sown by Martin Luther. Neither is Luther to be condemned as an individual, because some direful results followed from his teachings, any more than King David is to be considered a saint, because the Lord used him as an amanuensis through whom some of the Psalms were written.

† "The Apocalypse Today: A Brief Introduction to Swedenborg's 'Apocalypse Revealed,'" by Wm. F. Wunsch.

for its times. John had to be very circumspect. The churches in Asia had to read the veiled writing "between the lines."

Who was the man with the number of the beast? Nero, the persecutor. Nero, who had planned to throw John into a cauldron of boiling oil, but was deterred, because at the last moment a most terrible thunder storm burst over Rome, which the superstitious Nero interpreted as a sign of the disapproval of Jupiter, and so commuted the sentence to banishment to the isle of Patmos. Numerals in Hebrew are denoted by letters of the alphabet which thus serve a double use. Nero's name in Hebrew becomes equally the number 666. It would not do for John to speak plainly, but those to whom his letters came, understood.

In Ezekiel, Chapter xli, we read of the measurement of the temple, and the series of measures at the entrance. The numbers being interpreted, not as lengths but with their phonetic value, make the name of Jehovah. "I am the door of the sheep," said Jesus. "By Me if any one shall enter in he shall be saved." (John x, 7, 9.) Behold the seamless garment of the Lord. The Old and the New Testaments are of one piece.

Both cardinal and ordinal numbers have the same correspondence. It is interesting to note that the fraction $1/7$ is a circulating decimal of peculiar properties = 0.142857 142857 etc. The sum of the six significant digits is $1 + 4 + 2 + 8 + 5 + 7 = 27 = (3)^3$, or a number which emphasizes the fulness of completeness to the third degree, as seven emphasizes the significance of perfect holiness.

Referring to circulating decimals, Reverend Adolph Roeder says that this "signifies or represents the great law of series sometimes called by Swedenborg vortices or spirals." The reference is to Swedenborg's attempt to explain the motion which goes on within an elementary particle as flowing along

a spiral path. If we take a series of numbers, such as the squares of the natural numbers, 1 4 9 16 25 36 49, the differences are 3 5 7 9 11 13, and the second differences, 2 2 2 2 2, are constant. This gives the law of the spiral discovered by the great Grecian geometer, Archimedes, and called by his name. But, as I showed in my notes to the *Principia*, such a spiral will not do for finite nature, because it has no limit. The spiral for which Swedenborg was searching, but which seems to have been unknown to him, is the sinusoid spiral.

There are mathematical functions by which spiritual laws can be expressed. As we learn more of this science, we shall undoubtedly be able to penetrate more deeply into spiritual truths.

In "Apocalypse Revealed," n. 570, we read:

It is said of the dragon, that he had upon his heads seven diadems; but of this beast of his, that he had ten diadems upon his horns. The reason is, because the power of falsifying many truths of the Word is here signified, but there the falsification of them all.

Ten crowns on the horns signify the power to falsify *many* truths, but seven crowns on the heads signify the falsification of *all*. This illustrates that in spiritual significatives mere numerical value is of no account whatever. The smaller number has here the fuller signification.

In what is said of the beast out of the sea, that "there was given to him authority to work forty-two months" (Rev. xiii, 5) we read in "Apocalypse Revealed," n. 583:

By forty-two months is signified to the end of the former church and till the beginning of the New; the same as by three days and a half; and by a time, times, and half a time; also the same as by the thousand two hundred and sixty days; because forty-two months make three years and a half.

Seven times seven years signified the fulness of holiness and was followed by the year of Jubilee in the Jewish Church.

But seven times *six* months is fulness of vastation. Notice also that the exact number of days in three and one-half years is a little over 1278. But this number does not have the desired significance. Hence there is substituted for it 1260 days, or seventy times eighteen. Seventy, equally with seven, signifies fulness, and eighteen, which is three times six, means the completion of vastation, which is only another way of saying the same thing as is meant by the forty-two months.

It will be recognized from these examples, that spiritual significance does not care so much for literal precision but does away with this for the sake of a spiritual precision.

The apparent angular motion of the sun in a day measures very nearly a degree. The nearest whole number of days in a year is $365 = 5 \times 73$. These numbers are primes and cannot be further divided, which is not convenient for a standard of measurement. Therefore the Babylonish astronomers substituted the division of the circle into 360° . Each degree coincides only approximately with a solar day, but the system has the advantage that $360 = 3 \times 3 \times 2 \times 2 \times 2 \times 5$, and thus can be factored in a great many ways. Here the deciding argument is practical usefulness. But spiritual requirements are still more fundamental. Embodiment of Divine Truth is their paramount desideratum.

In "Heaven and Hell," n. 263, Swedenborg says:

I have seen writings from Heaven of mere numbers, written in order and in a series, just as in writings of letters and words; and I have been instructed that this writing is from the Inmost Heaven; and that their celestial writing . . . is presented in numbers with the Angels of a lower Heaven when the thought from it flows down; and that this numeral writing in like manner involves arcana, some of which cannot be comprehended in thought, nor expressed in words; yet with this difference: that numbers involve generals, and words singulars, hence it is that numeral writing involves more arcana than literal. From

these things it has been evident to me, that the numbers in the Word signify Things equally as do the words there. . . . In that writing in Heaven there is always prefixed the number on which those which follow in the series depend, as on their subjects; for that number is as it were the index of the Thing which is being treated of, and from which is the determination of the following numbers to the Thing in special.

One of the most beautiful passages in the Word, as seen in its spiritual sense, is that about Abraham pleading for Sodom: "Wilt Thou also consume the just with the wicked?" Swedenborg tells us that it represents the intense yearning of the Lord for the salvation of the human race. He interceded first for those with whom there should be truths, and those full of goods, who are signified by the fifty; also for those with whom there should be less of good, but still conjoined to truths, who are signified by the forty-five; then for those who have been in temptations, who are signified by the forty; also for those who have been in any combats against evils, who are signified by the thirty; afterwards for those with whom there should be states of affection for good from any other source, who are signified by the twenty; lastly for those with whom there should be states of affection for truth, who are signified by the ten; and the answer continually is, that they should be saved. (*Heavenly Arcana*, n. 2141.)

Lot with all the land before him, had chosen to dwell in the cities of the plain. All the world speaks the language of correspondences in references to the heights and depths of character. Every one knows the implication when it is said of anyone: He is a *low* fellow. And we require of anyone in whom we would put our trust, that he "measure *up*" to a certain standard. Abraham dwelt among the *hills* of Hebron. But of all the vile people of the Earth those of Sodom were the lowest and they lived in the lowest spot on the Earth's surface. Longfellow needed no interpreter when he pictured the young ambitious student, eager to attain the degree, *magna cum laude*, for intellectual proficiency, as scaling the mountain heights.

A youth who bore 'mid snow and ice,
A banner with the strange device,
Excelsior!

When the state of the world becomes so low as to be unbearable, then comes Judgment.

And Jehovah said, Because the cry of Sodom and Gomorrah has become great, and because their sin has become very grievous; I will go down now, and see whether they have made a consummation according to the cry of it which is come unto Me; and if not, I will know. (Gen. xviii, 20, 21.)

Then comes that tender pleading which assures us that all Divine Judgment is tempered with Mercy.

If we have chosen to dwell in the cities of the plain, if we have allowed ourselves to be ensnared by the lusts of the flesh, the deceitfulness of riches, the worship of the great "I, myself, I," then may the angels take us by the hand, as they did Lot ("Jehovah being merciful unto him") and lead us out of the city of destruction. Once led out, flee for your lives to the mountains and look not back!

The carpenter must measure and cut his boards square, that he may build a perfect house. We are building our heavenly houses now. Be careful to build them according to the "measure of a man." It is not difficult to do so. The simplest numbers are most used in the Word and have the highest significance. That which we should know is made easy.

"So teach us to number our days that we may get us a heart of wisdom." The Judgment is at hand. The books are opened. The Lord's angel is at the door *with the measuring reed*. The specification is in the Word of God. Will the house, builded eternal in the heavens, come up to specifications? Or must the wail be heard: "Numbered, numbered, weighed, divided"? "Turn ye! turn ye! for why will ye die, O house of Israel?"

GENUINE SYMBOLISM REQUIRES CAREFUL DISTINCTIONS

How futile is the attempt to recognize genuine symbolism without a knowledge which comes from heaven may be seen from the following example:

When Julia Ward Howe wrote the ringing words of her "Battle Hymn of the Republic" under thrilling circumstances which will live in history, she tried to give the feeling of a Divine leadership in the conflict by the lines:

Let the Hero born of woman
Crush the serpent with his heel!

Far be it from me to deny the effectiveness and grandeur of the poetry; but the theology is infected with the false doctrine of Arianism. The Arians have no objection to the idea of Jesus as a hero, but refuse to acknowledge Him as God. Yet only God could accomplish the overthrow of the hells (symbolized by the serpent). Therefore we read in the ancient prophecy:

And Jehovah God said unto the serpent, Because thou hast done this, cursed art thou above every beast, and above every wild animal of the field; upon thy belly shalt thou go, and dust shalt thou eat, all the days of thy life. And I will put enmity between thee and the woman, and between thy seed and her seed. He shall trample on thy head and thou shalt wound his heel. (Genesis iii, 14, 15.)

It was the *head* of the serpent that was to be trampled upon. Only by smiting the head could iniquity be overthrown *at its source*, and this was a purely Divine work. The *heel*, the lowest part of the body, was the only vulnerable part of the assumed humanity. This could be wounded by the serpent and was put off by the Lord in the glorification of His Human. The finite part of the assumed human could suffer, be tempted, and be wounded by the serpent, as to the heel, but it was not the finite part of the humanity which got the victory. The

Arian doctrine, that Jesus was an ordinary finite man, however good and noble, destroys the doctrine of the Incarnation with which the Sacred Scriptures are filled from beginning to end; and it is a characteristic perversion in that it substitutes the heels for the head.

Genuine correspondential truth comes down from God out of heaven.

CHAPTER XIV

EGYPT

THE Egyptians, who were better acquainted with representatives than any other people, made to themselves figures of beasts, as of calves, serpents, and various other kinds, and this on account of their signification, for they were not intended for worship at the first, but their posterity, who from internal became external, consequently merely natural, looked upon those things not as representatives and significatives, but as things holy, appertaining to the church, and thence devoted to them idolatrous worship; hence it was that the posterity of Jacob, being altogether external men, were prohibited to make to themselves any likenesses of such things, for they were in heart idolatrous. Thus, for example, the reason why they worshiped calves in Egypt, and afterwards in the wilderness, was because a calf signifies the first affection of the natural man, together with its good of innocence; the gentiles also everywhere worshiped serpents, because the serpent signified the sensuous principle, which is the ultimate of the natural man, and the prudence thereof; and so in other cases. (*Apocalypse Explained*, n. 654, p. 23.)

In Isa. XIX, 23-25, the Spiritual Church is treated of; the Spiritual of which is Israel; the Rational is Asshur; and the Scientific is Egypt; which three constitute the intellectual things of that Church; and which succeed in their order; wherefore it is said, Israel shall be the third with Egypt and with Asshur: and blessed be Egypt my people. (*Arcana*, n. 2588, p. 13.)

In ancient times the church existed in many kingdoms of Asia; as in the Land of Canaan, in Syria and Assyria, in Arabia, Ethiopia, Egypt [then an Asiatic power], Chaldea, in Tyre and Sidon, and elsewhere. (*Apocalypse Explained*, n. 422.)

The Ancient Church [which preceded the Israelitish], extended through a great part of the continent of Asia, and was divided, like our church at the present day, into many churches. In it was the Ancient Word. (*Ibid.*, n. 1177.)

Swedenborg's assignment to Egypt of a correspondential meaning, which everywhere related to knowledges and scientifics, is amply supported by modern discoveries which show that ancient Egypt excelled all the other nations in science. But modern science has not comprehended the hidden wisdom concealed in the Egyptian hieroglyphics and imagines that the Egyptians had evolved a childish and grossly superstitious cosmogony, inferior to that of the lowest savages; whereas, before the Ancient Church was corrupted, it surpassed all in knowledges. It is true that a beginning has been made in certain quarters, looking towards a more rational and truly scientific interpretation of the facts, but the adequate study of the hidden wisdom needs Swedenborg's methods.

The principal reason why most of the documents which have come down to us are of a religious character is, that all the ancient monuments of Egypt have perished except some which were necessarily of a religious nature—the temples and the tombs. The palaces of kings and nobles have utterly disappeared. Our knowledge of Egyptian civil architecture is derived from paintings in the tombs. Many texts of historical interest have been preserved, but their original intention was not historical, but religious. . . . All the objects in our museums and other collections which seem to belong to civil or domestic life have only been preserved by being buried in the tombs. (Renouf. *The Religion of Ancient Egypt*, p. 28.)

"The first step to be taken in the endeavor to obtain light out of these materials is classification, and the most essential kind of classification at starting, is that of the order of succession." (*Ibid.*, p. 29.) This being so, it is fortunate that some of our earliest information about Egypt is concerning the best preserved remains, and it is also the most important. I refer to what is known from the Great Pyramid.

The Great Pyramid of Jeezeh, built about 4200 B.C. at the command of King Khufui (or Cheops), is the largest and most wonderful building on earth. It has served a threefold

purpose: 1. That of an astronomical observatory. 2. That of a metrological museum, where the most important standards of measure are preserved. 3. It has served as a memorial of the most profound religious truths.

That the Great Pyramid of Jeezeh was first of all an observatory and was built with that end in view and in order to establish certain important astronomical data with the utmost attainable precision,—was demonstrated by the astronomer, Mr. Richard A. Proctor. He did not deny that the building may also have had other purposes,

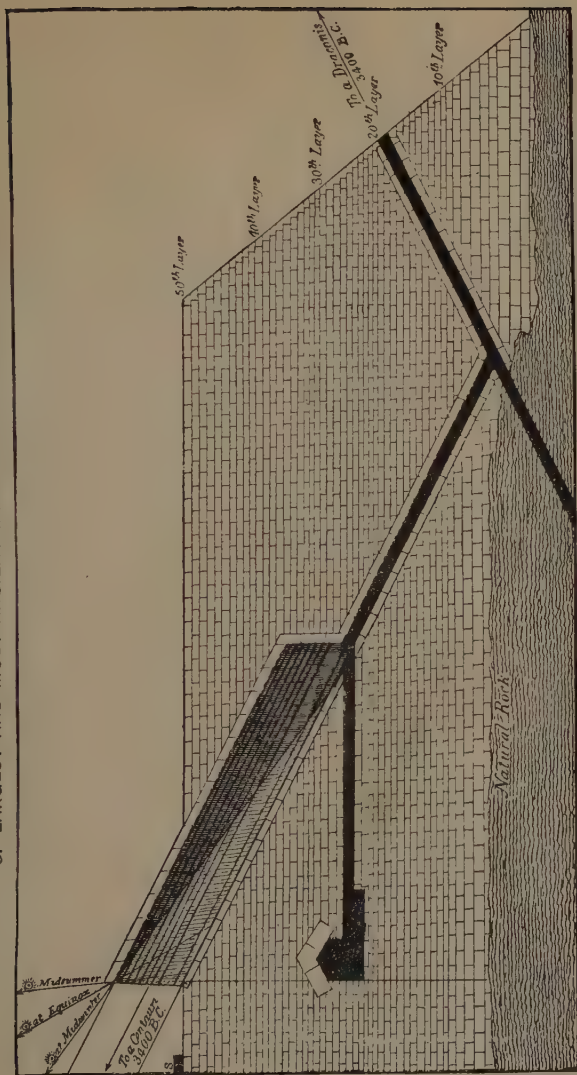
but when in dealing with such an edifice as the Great Pyramid the Egyptologist undertakes (as Lepsius has done) to question the astronomical character of qualities which none but astronomers and skilful ones could have given to those structures, and to deny the astronomical purpose of features as significant to an astronomer's eye as the Great Meridian Circle at Greenwich, he is passing outside the department he has studied, and his opinion is no longer of weight. (Proctor, *Old and New Astronomy*, p. 23.)

What arrangements the pyramid astronomers made for extra-meridional observations we do not know, and probably never shall. But the arrangements for observing the heavenly bodies when passing across the meridian were effective in the extreme, and no astronomer can doubt their significance. (*Ibid.*, p. 24.)

Fig. 14 (taken from Proctor's Fig. 3, Plate 1) shows a vertical section through that part of the Great Pyramid, containing the ascending and descending passages, the Grand Gallery, and the so-called Queen's Chamber which was probably the clock-room of the observatory, being convenient to the observer's stations and protected by massive walls of masonry, suitable for maintaining a constant temperature. All of these passages lie in the plane of the meridian, which is 25 feet east of a meridian section through the center of the pyramid.

The entrance passage is the prolongation of a long tunneling cut into the solid rock to below the middle of the pyramid's

3. LARGEST AND MOST ANCIENT MERIDIONAL INSTRUMENT KNOWN.



VERTICAL SECTION OF THE GREAT PYRAMID, SHOWING THE ASCENDING AND DESCENDING PASSAGES, GRAND GALLERY, AND QUEEN'S CHAMBER.

FIGURE 14.

base. Herodotus tells us this tunneling was cut before the pyramid was built; and I have shown in my treatise on the Great Pyramid [says Proctor] that in this way only could the pyramid have received its marvelously exact orientation—certainly ten times more exact than the astronomers of Europe in the time before the telescope could have attained. This passage was in all some 380 feet in length, and four feet square; carefully lined along a portion of its length, with fine granite from the quarries of Assouan (500 miles away). It bore on the pole star of the period, . . . when on a meridian below the pole, and doubtless served for the perfect orientation of the building, . . . until the level [of the entrance] had been reached. For higher levels a similar ascending passage was taken up from [the junction of the two passages] southwards, into the very body of the pyramid, the rays of the pole star being doubtless [or possibly] reflected from a water surface temporarily formed [at said junction]. Once, perhaps, each year the observation was renewed. . . . We have evidence of this process, in curiously close fitting of the stonework [near the junction of the passages] (according to Professor P. Smyth "a secret sign," but more naturally explained as intended to meet the requirement I have indicated.) [Up to the beginning of the enlargement of the ascending passage], the internal passages were for construction purposes alone, or chiefly. But [here] begins the finest pre-telescopic transit instrument ever made, the Grand Gallery, bearing directly upon the meridian. It was about 156 feet long (four times the length of the great Rosse telescope), 28 feet high, and, in its widest part, 6 feet, 10 inches wide.

Fig. 5 is a section of [a part of] this magnificent transit tube, which was lined with the finest and most beautifully polished stone. It is obvious that vertical sides would have been unsafe. . . . The section shows the ingenuity with which the builders combined sloping sides, essential to safety, with vertical walls, essential to astronomical security.

The interior of the Grand Gallery is shown although an imaginary vertical section, cutting off one fourth of its upper portion, in [Fig. 15 from Proctor's] Fig. 7. The black sky of night is supposed to be seen through the tube, a long vertical slice of the meridional part of the sky being commanded. The ramps all

along either side of the lowest portion of the gallery will be noticed. In each are seen seven out of twenty-eight rectangular openings cut into the stone. I forget what special mystical meaning Professor Smyth finds in the ramps and holes. I am content myself with the comparatively commonplace idea that they were intended for the convenience of observers, cross-benches being made with attached blocks at each end. These blocks could be slipped into any two holes facing each other, so that a comfortable and safe thwart seat could be provided, whence an observer (one perhaps of several working simultaneously along different parts of the gallery) could observe the transits of the heavenly bodies. (*Ibid.*, pp. 24-26.)

It was decided when the building was planned that there were to be exactly fifty layers of stone up to the level at which the Grand Gallery ends, and this for the reason that this number was an important secret factor to be used in computing some of the data in which the astronomical results were to be recorded. Proctor calls attention to the fact, that these fifty layers "are of unequal thickness, and probably designedly, since there are reasons for supposing that the whole work of building proceeded not only under the direct supervision of the astrological priests, but in strict subordination to the supposed indications of the heavenly bodies." (*Loc. cit.*, p. 27.)

It seems to me that the inequality noted may have proceeded from a different cause. In order to determine the approximate dimensions of the proposed building, the numerical values of the astronomical quantities must have been already known in a general way, having been obtained by means of similar but less perfect structures. It was to put the finishing touches on these observations and to get the final definitive values of certain constants, that the observatory was built. Observations could be commenced by means of the Grand Gallery before this was finished, observations which were better at least than the earlier ones, and corrections to the adopted values could be obtained from time to time as the work progressed. Thus the



FIGURE 15.

height of the fiftieth layer appears to have been overestimated at first, and accordingly the thickness of the layers was reduced. Near the end this reduction was found to have been overdone and the fiftieth layer was made much thicker to arrive at the correct value.

What means the transit observers had for taking altitudes we cannot now determine. Probably the double groove [which is shown near the bottom of the fifth layer of stones above the ramp] may have been used for carrying sliding frames by which altitude and possibly true transit epochs too were determined. So far as the time of transit was concerned, there would be no difficulty, as the moments of a star's ingress and egress would, of course, precede and follow the true transit epoch by equal intervals, giving the mid-moment for the moment of transit. Still, in special cases, a vertical line or edge dividing the field of view exactly in half might have been used with advantage. Horizontal cross-lines or edges would give the meridional altitude very satisfactorily. We may even imagine, seeing how ingenious the astronomers of the pyramid manifestly were, and how admirably the Grand Gallery would have lent itself to such work, that screens may have been used for solar observations. By using at the upper end of the gallery an opaque screen with a small aperture (preferably but not necessarily circular) and receiving the sun's light upon a smooth white surface placed at right angles to the sun's direction, a much magnified image of the sun would be formed, on which any spots which chanced to be present on his face would be well shown. The Egyptians were certainly acquainted with the fact that in this way an inverted image of an object can be formed; and if they ever tried the experiment in the case of the sun, especially in the winter months, when, as shown in Plate I., his rays penetrated far down the gallery, they could not have failed to detect the sun-spots. (*Ibid.*, p. 28.)

From Col. Howard Vyse's map of the area containing the pyramids of Jeezeh, the latitude of the Great Pyramid is given as $29^{\circ} 58' 51''$ and the angle which the entrance passage makes with the horizon was found by Prof. Piazzzi Smyth

to be $26^{\circ} 27'$. Correcting for refraction, we have $26^{\circ} 2' - 2' = 26^{\circ} 25'$ and $29^{\circ} 59' - 26^{\circ} 25' = 3^{\circ} 34'$, as the angle which the axis of the pyramid's entrance passage makes with the direction of the pole, that is, of the earth's axis.

In the next place, from the known precessional motion of the stars, it is found that the star α *Draconis* had almost precisely this polar distance, $3^{\circ} 34'$, when at its closest approach to the pole, which occurred in 3400 B.C. Consequently, at the time α *Draconis*, then a much brighter star than it is now, shone centrally down the pyramid's entrance passage at its lower culmination. Proctor assumes that this event, the nearest approach of the then pole-star to the pole, was commemorated by the pointing of the passage, which seems a safe conclusion. He then further assumes that this fixes the date of the building of the pyramid, as having occurred at the same time. But this by no means follows, because the pole star could have been observed through the tube at any rate during several centuries before or after nearest approach, and its exact position could have been measured.

Mariette places the date of the Fourth Dynasty, that of Seneferu, at 4235 B.C. Mariette, consequently, would make Seneferu (the Snofru of Maspero) date his reign from the beginning of the first Sothic cycle. But there seems more reason to suppose that the first cycle started with the building of the Great Pyramid by his successor, Khufu, to whom, therefore, this date approximately may be assigned.

In his "Precession: and the Pyramids" (Popular Science Monthly, April, 1912), Dr. Lowell, who adopts Proctor's data and dates, tells of some interesting facts connected with the pyramid:

If we calculate the angle from the vertical which the end of the cornice makes with the upper end of the floor we shall find it 6° ($6^{\circ} 20'$). Remember that the latitude was 30° ($29^{\circ} 58' 51''$).

and that the obliquity of the ecliptic was then 24° ($24^{\circ} 4'$). Now subtract the second angle from the first to get the altitude [co-altitude] of the sun at the summer solstice, and we have 6° . Consequently at that season the shadow of the gallery roof would just strike the south end of the gallery floor. A curious astro-nomic coincidence, you say. But go a little further. Let us calculate the angle from this same coping down to the end of the central incline on the gallery floor. It comes out $36^{\circ} 10'$. Now at the winter solstice the sun was $30^{\circ} + 24^{\circ}$ from the zenith or 54° , that is, 36° from the horizon, the angle just found. In midwinter then the sun shone just to the bottom of the effective gallery, as at midsummer it had marked its top. Between these two extremes the shadow must always fall. Thus the gallery's floor exactly included every possible position of the sun's shadow at noon from the year's beginning to its end. We thus reach this remarkable result, that the gallery was a gigantic gnomon or sun-dial telling, not like ordinary sun-dials the hour of the day, but on a more impressive scale, the seasons of the year. (*Loc cit.*, pp. 458-9.)

Thus the Grand Gallery was especially suited for solar observations at the time of meridian transit. But this has no bearing on the question of dates. It is entirely independent of precession. The only thing which can change these relations is a variation in the inclination of the ecliptic, a variation which proceeds very slowly and within narrow limits. The positions of the shadow in summer and in winter are shown in Proctor's figure (Fig. 14), as is also another interesting occurrence, namely, that near the epoch of the closest approach of α *Draconis* to the pole, the very brilliant star, α *Centauri*, the nearest star to our sun, shone centrally down the gallery of the pyramid. Both of *these* events are connected with precessional motion and are sufficiently remarkable to place these stars as landmarks of the sky, singled out from the innumerable starry hosts.

At the time when the pyramid was used for an observatory, it must have ended at the fiftieth layer of masonry, and prob-

ably in a square platform. It had unsurpassed instrumental facilities by which were obtained the numerical data, recorded after the favorite Egyptian manner in an enigmatic cipher which, however hard it may be to read, had the merit that it was preserved in imperishable granite and marble. From this cryptic record Mr. W. M. Flinders Petrie was able to show in 1867 that the pyramid astronomers had determined the distance of the sun with an accuracy surpassing that of the work of modern astronomers, and which continued to excel for another quarter of a century after Petrie's decipherment, until within a very few years the moderns have at last caught up.

Another notable achievement of the pyramid astronomers was the determination of the Earth's dimensions and the fixing of the standard of length (and thence of other measures). The pyramid inch = 1.001 British inch, is the 500,000,000th part of the Earth's axis of rotation, the British standard being a slightly erroneous duplication of the same, probably derived through the Druid priests. The "sacred" cubit, the "cubit and a hand breadth" of the Sacred Scriptures, was equal to 25 pyramid inches, or 25.025 British inches, and was therefore longer than the cubit in ordinary use by the Egyptians (20.6 inches) by over 4 inches.

We may presume that the records of observations obtained with so much labor must have been preserved, but only among the secret archives of the priests which, possibly, we shall find when that diorite-lined inner chamber of the Great Pyramid (of which there is some evidence from the remains of chips of polished diorite, found in neighboring debris, but not known *in situ*) is discovered.

THE MESSIANIC PROPHECIES OF ANCIENT EGYPT

When Swedenborg offered to make known the meaning of the Egyptian hieroglyphics to his fellow scientists, the offer was

not accepted, and he never recurred to the subject, which evidently did not interest his associates; but today science is very much interested in the Egyptian antiquities, and it is well that students of Swedenborg should apply his methods, as Mr. Odhner has done so successfully, to the interpretation of the secrets of Egypt. The modern archeologists, with a few exceptions, have viewed these antiquities as examples of a gross imagery, an infatuated idolatry, or a false theology, to be explained by comparison with the fetish worship of savages, and consider themselves to be on a far higher level of spiritual and intellectual attainment. This contemptuous attitude and this predilection for material and gross translations and interpretations of the hidden wisdom of Egypt has blinded the eyes of many most learned expositors. Such cannot be safe guides, though the data which they accumulate may be used to better advantage by others who are willing to let spiritual truth lead them.

Among those who have tried to elevate our conceptions of the ancient wisdom Dr. J. J. Garth Wilkinson is easily foremost, but others who are not New-Church scholars have also contributed suggestions which are worthy of consideration. Among these, Gardner Wilkinson, Wallis Budge, P. Le Page Renouf, and Marsham Adams may be mentioned. Renouf, in his "Religion of Ancient Egypt," argues that the simplicity of structure of the Egyptian language did not conduce to the expression of the niceties of philosophic thought, and that, with such a poor instrument, we need not expect to find among the Egyptians great logicians or philosophers, such as Greece or Germany have produced. But we may reply that for the reception of spiritual truth, this is not necessary. The open mind and the innocent heart are the essentials here. It is recorded of Jesus that the *common* people heard him gladly. Swedenborg, indeed, points out that great learning has often

been a barrier to the reception of spiritual truth, simply on account of the pride which it has engendered. While acknowledging that much of the imagery of the Egyptian religion, as well as its numerous personifications of the forces of nature—Ra and Thoth = Sun and Moon, Seb and Nut = Earth and Sky, etc.—are based on a *mythology* dealing only “with those phenomena of nature which are conspicuously the result of fixed law,” Renouf shows conclusively that the religion founded on this “recognition of law and order” is wholly symbolic. This religion “was not from the first that mere worship of brutes which strangers imagined in the days of its decline.” He says that “the Egyptians from the very first spoke of the Power by whom the whole physical and moral government of the universe is directed, upon whom each individual depends, and to whom he is responsible.” That the conception may have ended in a pantheistic identification of God and nature is perhaps true, but let us inquire of the more ancient edifices and records, and see if they do not bear witness to a more rational belief. The ideas put forth by Mr. Adams are especially noteworthy and should be better known to New-Church students. In what follows, I have quoted at some length from one of his books and find little to criticize, except from the astronomical side, where more expert knowledge is occasionally required. The work cited is entitled, “The Book of the Master, or the Egyptian Doctrine of the Light Born of the Virgin Mother,” by W. Marsham Adams. Formerly Fellow of New College, Oxford. Author of “The House of the Hidden Places, a Clue to the Creed of Early Egypt from Egyptian Sources.”

In Nature's infinite Book of Secrecy

A little I can read. (*Antony and Cleopatra.*)

New York: Putnams. 1898. pp. 204.

A few questionable statements should be noted: (p. 30) The

moon is said to cover "a space equal to its own disk in just an hour." The average time is a trifle over 58 minutes. As an approximate derivation of the hour, this may suffice. The moon was the first measurer; but the sun was the final arbiter of time. The degree is in turn very nearly the arc traversed by the *sun* in a day and gave the division of the circle into 360 parts as the nearest approximation which could be readily factored.

(p. 130, also 38 and 131) The sun is said to traverse "in a period of four years (the grand cycle of the Egyptian astronomers) a space about equal in length to the annual path of the Earth." The sun is now known to travel as far in one year as the Earth does in seven. (Dayton C. Miller.)

(p. 132) The length of 25.025 British inches is said to be $1/10,000,000$ of the Earth's polar axis, instead of $1/20,000,000$.

(p. 140) A "polar inch" = $1/25,000,000$ of the axis, instead of $1/500,000,000$.

(pp. 138 and 141) The approximations to the perihelion cycle are quite rude.

He relates the length of the Grand Gallery (1881 inches) to the perihelion cycle = $1881 \times 100 \times \sin 26^\circ 27' = 96,530$ years, taking an inch to a year.

Similarly, he supposes the 57-inch cubit of the XI Dynasty was derived from the half of the perihelion cycle, divided by 1000 (he says 10,000 by mistake):

$$2 \times 57 \times 1000 = 114,000 \text{ years.}$$

Two different numbers, and neither of them right! Young (General Astronomy) gives the correct value, 108,000 years.

(p. 138) He suggests the following origin for the ordinary cubit:

If we consider the cycle of the equinox [precessional] as a circle of about 25,800 years, the radius is about 4122 years and, taking

a century to an inch, the half radius gives the well-known cubit of 20.6 inches.

$$\begin{aligned}\text{But 1 ordinary cubit} &= 20.64 \text{ British inches} \\ &= 20.62 \text{ Pyramid inches}\end{aligned}$$

$2 \times 26.62 \times 100 = 4124$ years; $2\pi \times 4124 = 25,912$ instead of $2\pi \times 4107 = 25,800$ years, the number adopted for the cycle.

(p. 141) He assigns a lunar significance to the length of the lower ascending corridor of the Great Pyramid:

7×223 inches = 1561 inches (found 1542) Derivation = Seven cycles of eclipses, "corresponding with the seven Halls of Judgment in Truth of which we read in the Ritual." Each cycle contains 223 lunar months.

These coincidences are not close enough to compel assent, not to mention a number of actual blunders. After so many slipshod numerical statements some might be inclined to throw the book aside and pay no further attention to it. But a man may have "no head for figures" and still be able to offer useful suggestions in other directions. Such are some which clear up puzzling chronological discrepancies already noted. I therefore plead for leniency and a further examination of the evidence.

On p. 122 Mr. Adams says:

What the concealed significance may be of that secret masonry [of the Great Pyramid of Jeezeh]; for what purpose the complex plan was designed; at what epoch the huge structure was erected, are questions which have perplexed many minds in many lands, and have resulted in a discord more akin to Babel than to the grandeur of its silent majesty. It was built by the Jews in the days of their captivity, just to give them something to do, says, or rather said, one school of theorists. It was built by Chemnis, but attributed by Egyptians in hatred of him, to the shepherd Philition, is the account of Herodotus. It was built by Ibn Salluk, say the Arabs, just before the flood, to preserve the royal treasures from the predicted inundation. It was built by

Melchizedec—or somebody—vehemently asserts the Scottish Professor of Astronomy, who seems always to write in a whirlwind of miscellaneous indignation. It was indisputably intended by the founder for his tomb, one party stoutly maintains,—a tomb in which he left special instructions that he should not be buried, and in which nobody could possibly have been buried, replies another. It was an observatory, maintains a third,—where every place for observation was carefully closed up, retorts a fourth. It is the “prophetic floor-roll of human history,” screams Professor Smyth,—with all the dates gone wrong, softly sneers Mr. Flinders Petrie.

Instead of any or all of these suggestions, Mr. Adams believes that this pyramid was the *Secret House of the Master*, used for initiation into the priesthood, and symbolizing by its passages and chambers a secret Wisdom, founded on astronomic truths, but really relating to the divine laws of the future life and to the regeneration of the human soul, described in correspondent language in the treatise usually called “The Book of the Dead,” according to that vicious nomenclature which has eyes for only death and can speak of a future “life” only in terms of a problematical existence founded on materialistic conceptions; but which bears witness to those who have eyes to see, of a very different view, in the literal translation of the title of the book, *The Book of the Master of the Secret House*. That house was the “Light” of Egypt, and initiation, significantly described as “the entrance on light,” was typical of resurrection into the heavenly world and reception into the fulness of light and life in that world. Mr. Adams presents something of this conception and also endeavors to connect the secret house and its mysteries with the temple of the Virgin Mother—Hathor—in Denderah.

The Great Pyramid is certainly not only the greatest, but the most extraordinary building in the world. Proctor’s arguments must convince any astronomer that its interior passages were designed for astronomic use. I do not see how there can

be the slightest doubt that the pyramid was truncated at the fiftieth course, and used as an astronomical observatory of great perfection. That it had a predecessor is indicated by the fact that various astronomical data are recorded in several of its dimensions with close approximation and to that extent must have been known when it was planned. Others, such as the Earth's dimensions and the sun's distance need not have had their final values assigned until the working part of the apparatus had advanced in its construction enough to be used. Therefore there cannot be a doubt that this magnificent meridian instrument was used to still further improve these data, and if astronomic knowledge was regarded by the builders as the supreme natural knowledge, one can see why they may have elected to immortalize their knowledge in some of the dimensions of the structure. But since the building was eventually closed up, there is no reason why it should not have been designed originally with a further and final purpose, namely, that it would serve as a metrological museum and thus that it should be a house of initiation and instruction into the most important cosmical knowledges. But since the Egyptians placed the knowledge of spiritual things far above that of natural science, and also knew that such knowledge can only be given to those who are prepared to receive it, there is much cause for surmising that spiritual as well as natural knowledges were expressed in symbolic forms in the building; and thus that the house of secrecy could serve for initiation into the mysteries of *all* knowledge, both spiritual and natural. In the hands of a mystery-loving priesthood, this would be the final and supreme use of "the secret house." This, therefore, is Mr. Adams' proposition: That the secret house and the sacred book are indissolubly united by a common purpose and contain in symbolic form the supreme knowledge of immortal life to be received at the hands of "the Master."

But who is *the* Master? None other than He who said: "Ye call Me Lord and Master, and ye say well, for so I am." And because the Lord as the Sun of Heaven was to descend bodily to earth, therefore at a point in Egypt over which, at a certain date, the sun at midsummer stood almost vertically, there was erected a temple dedicated to the *Virgin Mother*; and the erection of this temple was made a part of the completion of the plan of the Great Pyramid of Jeezeh—transliteration of the Arabic = Hebrew, Jeezer, Father of help. (Numbers XXVI, 30.) May we not call the latter the Pyramid of Jesus the "everlasting Father and the Prince of Peace"? Since its symbolism relates to the judgment of the soul by the spirit of truth ("the Father judgeth no man, but hath committed all judgment unto the Son"), since Osiris—the all-seeing eye—is no other than the divine truth, since the pyramid itself is an image in stone of the fountain of the waters of Eden divided into four heads, since from the combination of the numbers *three* and *four* in its exceedingly simple plan (which can, notwithstanding extreme simplicity, embrace some of the profoundest truths of earth and heaven) this unique building is able to typify the judgment of Omniscience as to truth in its fulness (meant by the number three), derived from the perfection of good (meant by the number four), since also its dimensions especially refer to the relations between the sun and *this earth*, of all earths the one on which the Lord was to appear in human form as the Christ, the Master,—this embodiment of the teachings set forth in "The Book of the Master of the Secret House" rightfully bears His name, and is indeed the "Light" of Egypt, as Jesus is *the Light of the World*.

Similarly, the temple of the "Virgin Mother," by its name "place of the orbit" (like Philæ by its position under a zenithal sun), was capable of symbolizing the Incarnation—the most wonderful, the most sacred mystery of creation. Isis

(Hathor), sister and wife of Osiris, and mother of Horus, *who is also Osiris*, while remaining herself the daughter of Osiris, receives the significant title of "the Virgin Mother." We do not seek to lift the veil of Isis. There are some things too sacred to be revealed to any who are not already close to the heart of God. It is enough to point out that in no sense whatever, can that extraordinary conjunction of epithets—mother, wife, and daughter, in one—be applied to any other human being than to that child of God who was chosen to be overshadowed by the "power of the Highest," and to bring forth the Son of God.

A remarkable relation has been brought to light by Mr. Adams between the Great Pyramid and the Temple of Denderah, but owing to his failure to grasp the fact that the pyramid, besides recording some very important astronomical data, was itself an astronomical observatory, presumably during many centuries (for one does not see why it should be closed up until all possible observations were obtained), he does not seem to have noticed that some of the data which he has gathered give a clue to the reconciliation of several long-standing discrepancies. If we are willing to admit with Mr. Richard A. Proctor that the pyramid was for some time a *truncated* pyramid ending at its fiftieth layer (though he limits its duration as such unnecessarily and scarcely allows time for it to accomplish what it seems to have done), and that while thus constituted it was a superb astronomical instrument; and if we *reject* his hypothesis, that notwithstanding this obvious utility, the instrument was almost immediately closed up, before it had an opportunity to gather more than a small fraction of these observations for which it was peculiarly fitted, and was converted into the tomb of its builder, the way lies open for the reconciliation of the opinion of many astronomers, that the building was probably erected when α *Draconis* was

within a specified distance from the pole, and the researches of the archeologists who assert from historical evidence that Khufui, the reputed builder of the pyramid, whose name is found in mason's marks on some of its stones, lived some eight centuries before the first date assigned by the astronomers. Mr. Adams gives us the information which is capable of supplying the requisite connecting link, but does not himself apply it.

Memphis, or Men-Nofer, at "the apex of the Delta, the most distinctive point in the long course of the parent river, and marking the junction of the northern and southern kingdoms," was built by the fourth Dynasty, and its Great Pyramid was built "within a very few years of the foundation of the hieroglyphic kalendar," that is, about 4230 B.C. This date follows from the knowledge that the year 1317 B.C. began a new Sothic period, and that two periods before this, namely, in $1317 + 1461 + 1461 = 4239$ B.C.,* the true length of the year was determined by the astronomer-king Khufui, and the true, or sacerdotal year, was thenceforth fixed by the device of the Sothic cycle, which after $4 \times 365\frac{1}{4} = 1461$ years, causes the days of the year to recur in their original order. The point made by Mr. Adams is, that the founder of the Kalendar left secret instructions for the building of the Temple of Denderah at a particular epoch when the obliquity of the ecliptic was near a maximum, and when and where some other notable astronomical relations were capable of fulfilment. The difference of latitude between Denderah and the pyramid, according to Mr. Adams, is $3^{\circ} 53'$; [I have verified this approximately, from the rather poor map in my possession, getting $\Delta\delta = 29^{\circ} 59' - 26^{\circ} 9' = 3^{\circ} 50'$] and *six* times

* Oppolzer makes this 4236 B.C. Biot gives a different date, apparently from using a different definition of the "heliacal rising" of Sothis.

$3^{\circ} 53' = 23^{\circ} 18'$ is nearly the average inclination of the ecliptic through the ages. The $\Delta\delta$ of $3^{\circ} 53'$ "conveniently divides [the space between the equator and the ecliptic] into six equal parts on either side of the equator; and that is the space through which, owing to the effect of precession, the heavenly sphere appears to be shifted, once northward and once southward in the course of the vast cycle. Hence, then, we have the meaning of a remarkably beautiful image contained in the records, describing the temple as 'the seat of the Heavenly Dances in the Six Heights of Osiris,' that is to say, of the space-sweeping motions of the starry host through these six heights of the tropical heaven, as now advancing, now receding, they weave their never-ending measures, led by the star that marks the heavenly pole." (pp. 69-70.)

The all-important point for chronology is this: The star α *Draconis*, then the most brilliant star in the constellation, was approaching the pole by about $18''$ per annum, but did not shine centrally down the descending passage of the pyramid until

about the year 3440 B. C. that is to say, not in the time of Khufu but of Pepi [spelled Khufui and Papi by Maspero]. Eight centuries, therefore, it would seem, after the epoch when Khufu secretly designed the celestial plan of the universal temple, his royal successor, Pepi, who himself bore the title of Grand Master (Sechem Ur), recognized the signal that the hour had arrived for the manifestation of that design, when the star which indicated the celestial pole illuminated the dark masonry of the twin building [implying that at any rate the entrance passage of the pyramid remained unobstructed until after this event], and he saw the point "shining in the great house of watching," as it says in another part of the inscription. Until that hour should come, the Grand Architect concealed the design for the temple of the universe; when the predetermined measure of time was accomplished, the Grand Master erected the building on the spot measured by the star and the pole of the heavens. (pp. 68-69.)

The claim is virtually made here that 800 years after its erection, the pyramid was still used as the "great house of watching," or in plain language as an *observatory* where astronomers observe, or watch, the passages of the stars. No further specification was needed. There was no other *great* house of watching, even if some small imitations may have been subsequently constructed, not so much for the purpose of observation of the stars, but principally as mausoleums. The desire of some people to be buried in an observatory persists even to this day, and the body of James Lick is enclosed in the pedestal of the great equatorial of the Lick Observatory, founded by his munificence. The ancient Egyptian fashion being thus restored, the new Allegheny Observatory has been made a mausoleum for the body of the late Professor Keeler, a former Director of the Old Allegheny Observatory, and the body of the wife of the distinguished maker of telescopes, Dr. Brashear, has also been consigned to the same receptacle. But in spite of some apocryphal traditions, there is no reason to believe that the founder of the Great Pyramid was burdened by fancies of this sort; for with the exception of some workmen's labels naming probably the year of Khufui's reign when certain pieces of stone were quarried, since they record only the name of the King and the year, labels which would not have been seen but for the tearing apart of the work in a manner never intended, the entire structure is without hieroglyphic or pictorial decoration, other than some peculiar cryptic devices which will be described further on. In any case, except for the aforesaid builder's marks, the pyramid contains no allusion to Khufui, and this great man—maligned and misunderstood by his successors—stands revealed before us as the most learned man of all the ages, but also the most modest, if, indeed, he did design the pyramid, and unless possibly there may have been some unnamed power behind the throne. Ages after-

wards, Egyptian kings of little note were accustomed to cause their names to be engraved in all sorts of prominent places, somewhat after the fashion of the modern callow youth possessed of a jackknife, and had the impertinence to substitute their names for those which rightfully belonged there. But as far as known the Great Pyramid has remained undecorated and has preserved through the ages its majestic silence; and yet, for those who can read their message, these stones are eloquent. They tell of the ages, yes of eternity, for theirs is the language of a spirit which is timeless. Yet are they no cheap obituary epitaph. The so-called "sarcophagus" turns out to be a measure of volume, singularly related to the size of the Earth, and its dimensions are identical with those of Israel's Ark of the Covenant.

I have spoken of "apocryphal traditions." Ibn Abd el Hokm was probably, as Proctor suggests, a "romancist of the first water," and his account of what was found when the workmen of Caliph Al Mamoun (son of the great Haroun Al Raschid of Arabian Nights fame) first broke into the King's Chamber, is worthy of the marvels of those tales. Petrie simply says that they found nothing and expresses the opinion that the pyramids were rifled in the civil wars of the early times. As Smyth puts it: On entering the Chamber, they found "a right noble apartment, thirty-four feet long, seventeen broad, and nineteen high, of polished red granite throughout. . . . The room is clean, garnished too, as it were, and, according to the ideas of its founders, complete and perfectly ready for its visitors so long expected, so long delayed. But the gross minds who occupy it now find it all barren, and declare that there is nothing whatever for them in the whole extent of the apartment from one end to another; nothing except an empty stone chest without a lid." In all the place not a single *dirhem* of the expected treasure! (Smyth, quoted by Proctor.)

This is el Hokm's account of "a stone trough, in which lay a stone statue in human form, enclosing a man who had on his breast a golden pectoral adorned with precious stones, and a sword of inestimable value, and on his head a carbuncle of the size of an egg, brilliant as the sun, having characters which no man can read." (Maspero, "The Origin of Civilization," p. 370.) This has all the earmarks of an Arabian Nights tale. The sword was Islam's symbol. It was not customary for Egyptian kings to be thus buried.

The next point to be noted is that the entrance passage was not constructed for the exact observation of the pole-star through the passing of its rays down the entire length of the tube at the time of the erection of the pyramid; but the angle of elevation of the entering passage was chosen to fix an epoch and to record the date at which the obliquity of the ecliptic, or plane of the Earth's orbit, would reach a maximum value, and coincidentally with this epoch, the remote successor of Khufui was directed to erect on the site of the "place of the orbit" a temple recording the leading facts of orbital precession.

A few astronomical emendations need to be made in the account of this event as given by Mr. Adams.

The midsummer sun in those days stood at noon practically over the island of Philæ and not far from the zenith of Denderah. If then, says Mr. Adams, "an observer at Denderah should stand with his face to the north, as the temple records inform us that the founder stood when on the night of midsummer he laid the foundation stone of the building, he would have the plane of our orbit rising immediately in front of him, while the pole of the ecliptic would lie at his feet at the farthest verge of the celestial horizon." (p. 66.)

If for "night" we read "midday," the pole of the ecliptic would indeed be about 2° above the northern horizon on this day; but at midnight the pole of the ecliptic would have re-

volved into a different position, and the orbit which at midday would have passed nearly through the zenith, would then have passed far to the south, its pole being elevated by approximately $24^{\circ} + 26^{\circ} = 50^{\circ}$ (24° being the inclination of the ecliptic at the given date and 26° the latitude of Denderah nearly).

Seeing that Khufui attributed supreme importance to this precessional event, we might surmise that the angle above the horizon of the northern passage of the pyramid was intended to give not only the epoch of the event, but also to name the latitude of the place at which the occurrence was to be celebrated in such an imposing manner; and it does so with fair accuracy, indeed, with almost complete accuracy, if we substitute for the actual the *ideal* pyramid, which was probably always in the founder's intention, however difficult it may have been to secure its execution. We must remember that it is impossible to construct a great building with the same accuracy which can be attained in the instrumental measurement of angles. The elevations of the ascending and descending passages of the pyramid were undoubtedly intended to be the same, but they differ by about $10'$. The orientation is believed to be within $4'$ or $5'$ of the truth. Astronomically these are large errors; but for a building of enormous size to be executed by ordinary workmen, they represent a standard of accuracy which is not approached by the best modern structures.

What then was the ideal pyramid, and how closely did the actual one conform to it? To answer these questions we must consult such works as those of Greaves, Taylor, Vyse, Smyth, Petrie and Proctor, though it is not necessary to subscribe to *all* of the conflicting hypotheses of these authors.

The "Great Pyramid," according to Herodotus, was intentionally built so that the area of each face was equal to the square of the height. If so, the perimeter of the base must have been very nearly equal to the circumference of a circle

whose radius, p , is the height of the pyramid, that is, if b is the length of one side of the square base,

$$4b = 2\pi \times p$$

Let x = the angle of slant of each of the four faces. a = slant altitude of a triangular face. b = base of the triangle. p = height of pyramid. Then $p^2 = \frac{1}{2}ab$, and $p = a \sin x$

$$\sin x = b / 2p = p/a$$

Let $p = 1$. Then $\sin x = b/2 = 1/a$, and $ab = 2$.

By hypotheses,

$$\sin x = b/2 = \frac{1}{4} \times \pi = \frac{3.14159}{4} = 0.7853975$$

$$= \sin 51^\circ 45' 27''$$

Found by measured angles of casing stones, $51^\circ 50'$ and $51^\circ 52\frac{1}{4}'$. This approximation is as close as we had any right to expect and here, as in so many respects, the truthfulness of Herodotus is confirmed, at least to this extent.

Let us next suppose with Taylor that a square of side c was inscribed within a half section (meridional and vertical). Then $\cot x = d = \frac{1}{2}$ transverse basal section = 0.7881243. This is not quite equal to $b/2$, that is, the faces will not quite meet but will do so very nearly. The slant height a is divided into a' and a'' by the corner of the square on c . The half angle of the apex of the pyramid is the complement of x . $a' = (1-c) \sin x$, $a'' = a' \cot x$, $c = a' \cos x = 0.4407547$
 $1-c = 0.5592453$

By a further hypothesis of Taylor's, if $\Theta = c/p$, whence $\Theta = 26^\circ 9' 7'' 4$.

The actual angle is $26^\circ 27'$ and Smyth makes the mean of the angles of the various passages = $26^\circ 18'$. Here, again, we are within the probable errors of construction, and find the hypothesis acceptable: but the ideal Θ is even closer to the latitude of Denderah which is

$$\text{Latitude of Denderah} = 26^\circ 9'$$

In addition to the errors of construction, and while admitting that with the given plan of construction and the adopted unit of length, a large number of cosmical data could be typically represented with an extraordinarily close approximation to the truth, it need not be supposed that the data were supernaturally exact, and we should be prepared to recognize some errors in the adopted values for the ideal dimensions. Nevertheless, these stand the strain extremely well.

It is assumed that the founder's intention was to place the pyramid at latitude 30° North. It actually stands in latitude $29^{\circ} 58' 51''$. Perhaps the builders did not allow for atmospheric refraction, but even this is doubtful. Another reason suggested for the small discrepancy is that some difficulty in getting a suitable site compelled the selection of one not quite ideal as to location, but preferable for the sake of a secure foundation. This question of refraction would have no influence on the timing of transit observations, but would have to be considered if the taking of altitudes was attempted.

The ideal unit of length employed in the design of the pyramid is believed to have been the pyramid inch, equal to $1/500,000,000$ of the Earth's axis of rotation, and $1/1000$ of an inch longer than the British inch, according to Sir John Herschel—a value also adopted by Professor Smyth. There is abundant evidence that the common Egyptian cubit of 20.64 British inches was used by the workmen in the construction work, but the supposed astronomical design calls for some lengths measured by the sacred cubit, or Biblical unit of "the cubit and a hand-breadth" (Ezekiel XI, 5), needed at any rate for the ideal of Solomon's temple and presumably in the erection of the actual building. Two examples of this sacred cubit of 25 inches (very nearly our 2-foot rule so much used by carpenters) were found by Mr. Petrie near the pyramid site, which also dated back to the times of Khufui.

When expressed in pyramid inches or else in sacred cubits, some of the dimensions of the pyramid are found remarkably significant, being related to certain cosmical distances or durations. Thus one side of the base of the pyramid contains $365\frac{1}{4}$ sacred cubits, or as many cubits as the days in a year. If we prefer, we can take the whole circumference and consider it to represent the Earth's orbit during $365\frac{1}{4}$ days, giving to each day a length of 100 pyramid inches. There is good reason for supposing such a unit to have been intended in some cases, and this may be one of them, because there is a good deal of evidence that the scientific designers of this structure, while obliged to conform to ordinary usages in their units of mensuration, preferred a decimal system, and Professor Smyth, though not an advocate of the decimal system which is now accepted by scientists, relates with every appearance of exultation the triumphs of a different decimal system whose use by the pyramid-builders he considered established. He tells of his amazement on finding that his measuring rod of 100 inches exactly fitted the space of the diagonals of the corner stones of the great structure. Again, the sum of the width and height of the entrance-passage is $47.24 + 52.76 = 100$ pyramid inches. There are many instances of a relation between this ancient system of mensuration and the British system, which need not surprise us, since the ancient Druids had some things in their worship which remind us of Egypt and which possibly were imported from that source into the British Isles.

Another startling coincidence, though not an independent one, since it is necessarily involved in the adoption of the relations already specified, is that the sum of the two diagonals of the base (assuming that the height, p , is 5813 pyramid inches) is equal to 25,826 pyramid inches, "or almost exactly as many inches as there are years in the great precessional period"

(Smyth, p. 265, Proctor, p.65). Laplace made the precessional period 25,816 years, Bessel 25,868 and Nyren 25,824 years.

From the evidence now given that pyramid and temple form part of a common plan to celebrate an epoch of the great precessional period, we may even surmise that possibly this numerical symbol concealed in the foundation of the building was the leading motive in the choice of a plan to commemorate at the same time,—the three motions of the Earth, namely the precessional (by means of the basal diagonals), the orbital (by means of the basal perimeter) and the rotational (by means of the axial relation of the unit of length to the Earth's axis). That any simple geometrical figure could contain so many, so appropriate, and above all so close approximations to those astronomical facts, and these the three most fundamental facts of the Earth's motion as a member of the solar system, would seem almost incredible. If the design of such an all-inclusive plan was set as a problem before the ancient astronomers, its solution in such a simple way must have cost them many weary hours. Not much wonder perhaps that some have been inclined to see in this solution a supernatural revelation. There *are* spiritual symbolisms involved in this structure which connect it with a divine revelation to the Ancient Church; yet we should prefer to think that any of nature's secrets which are capable of being made known by patient investigation, will not be made the subject of immediate special revelation, but will await the slow process of scientific discovery. This being so, our admiration for the intellects which could compass the complexity of the precessional movement and also solve this problem, knows no bounds.

THE HIDDEN ASTRONOMICAL SIGNIFICATION OF THE GREAT PYRAMID

The actual precise length of a side of the pyramid's base, measured between the outermost corners of the sockets which

were cut in the solid rock of the hill to receive the four corner stones, has been the subject of some controversy. Though the intervening ground is now very rough from accumulated debris, it is still somewhat of a reproach to the modern measurers that their results are so discordant. As these measures become more reliable, the achievements of the ancient builders appear more marvelous, for they seem to have forestalled some of the most accurate work of modern astronomical observers.

The three most recent and most nearly accordant values for the length of a basal side of the pyramid, between sockets, are: British Royal Engineers of the Survey of the Sinaitic Peninsula

	British inches
(1st time)	9130
Same (2nd party, 1874).....	9140
Mr. Flinders Petrie (1880 to 1882).....	9126
Mean	9132

Theory, on the supposition that the length of the side (in sacred cubits of 25 pyramid inches) is equal to the number of days in the tropical year, gives $25 \times 365.242 = 9131.05$ pyr. inches, time being signified by a measurement of the period of orbital revolution, expressed as an equivalent length in a linear unit which is commensurable with the Earth's axis of diurnal rotation. Accepting this as the ideal pyramidal basal dimension, and since the rule for the shape of the pyramid given by Herodotus, though very close to the truth, is not fulfilled with complete accuracy, the alternative rule (suggested by Taylor) that the height was intended to be the radius of a circle whose circumference was equal to that of the base, itself representing the annual orbital motion of the Earth with the unit 1 day = 100 inches, may also be adopted. (This gives for the height

of the ideal pyramid: $p = (2 \times 9131.65) \div 3.14159 = 5813.00$ pyramid inches.) With these values of the vertical height and base, the vertical angle of slope of one of the four faces should be that whose tangent is

$$\tan \alpha = \frac{5813}{\frac{1}{2} \times 9131.05} = \tan 51^{\circ} 51' 14''.$$

The mean value measured from two known casing stones, found in place, is $51^{\circ} 51' 7''$ (compare ante, p. 83), which is extraordinarily close agreement and demonstrates the correctness of the theory.

But another and a most remarkable check is forthcoming. The antechamber to the King's Chamber is partially obstructed by a hanging leaf of granite with a raised knob, looking like a handle by which the leaf might conceivably be lifted if it were what at first glance it appears to be and that is a sliding panel, and suggesting the thought that here is something which will open secrets. The stone, however, is solidly cemented in the grooves of its retaining masonry, but the chamber to which it gives access does indeed contain the keys to several cryptograms of this "cipher" despatch. The only key which need be considered here is the distance across the antechamber in the direction of the passage to the King's Chamber. This distance is 116.26 pyr. inches, a number which does not immediately suggest anything in particular. In fact, it is an intermediate, or key number, to be used in connection with a distant part of the structure in unlocking its meaning.

The thirty-fifth course of masonry—this number being the product of seven by five (both of them significant pyramid numbers)—is notable for a sudden increase in thickness from 27 to 50 inches, causing this layer to be conspicuous, even when the pyramid is viewed from a distance. The reason for this sud-

den change, implying in the cryptic code of the builders that something of importance is associated with this layer, has been pointed out by Professor Hamilton W. Smith of Hobart College, Geneva, N. Y. If we take ten times the length of the antechamber, or 1162.6 pyr. inches, this is very close to the height of the thirty-fifth layer above the socket base. The height of the (ideal) pyramid above this layer into the tangent of the half apical angle of the meridional section is $(5813.0 - 1162.6) \times \tan 38^\circ 8' 46'' = 3652.42$ pyr. inches, or exactly ten times the number of days in the tropical year to six significant figures, expressed by the number of pyramid inches from the outer face to the central axis at this prominently marked level. The same key-number may have other offices, but this one alone is sufficient to demonstrate the reality of an elaborate system of architectural cipher, concealing fundamental astronomical truths.

In the preceding, as in some other instances, the strong mathematical bent of the architects is evident, because they have observed carefully the rule of the skilful computer, which requires duplicate computations by independent formulæ in order to establish every result beyond a doubt. Here the builders have hidden the same astronomical or metrological fact in more than one cryptogram, as if to make sure that these fundamentals shall not be overlooked, and also that their numerical values shall be fixed by independent cipher renderings, and established as the legitimate interpretation beyond the possibility of a doubt.

Another notable example of this multiplication of solutions, giving mutually confirmatory answers, is that of the standard of cubical capacity which we find in the great granite coffer in the King's Chamber. The inner contents of this vessel were evidently meant to be one-half the outside bulk. Owing to the dilapidated condition of the stone box from

modern wilful breakage, it is not easy to recover the dimensions with precision. Nevertheless, as if foreseeing these vicissitudes, the ancient metrologists have provided that their work shall not be lost, and have established it in several ways, so that, by means of their multiple record precautions, the errors of the redetermination cannot be very large. Thus Mr. Flinders Petrie finds 71,960 cubic British inches for the inner contents of the coffer, which is a little too large; but through compensation, he gets too small a value for the bulk of substance of the four walls and bottom (whose sum is supposed to duplicate their inner contents), or 70,630. The mean of the two, or 71,295 cubic British inches = 71,082 pyramid inches, should not be far from the intended volume. Piazzzi Smyth shows that *four* different ways of obtaining this number are optional, and he gives us in cubic *pyramid* inches:

(1) By interior length and breadth, and in place of depth, the ledge-breadth, giving 71,258.

(2) By interior of coffer, by all direct measures, 71,317.

(3) By half the exterior volume, directly measured, 71,160.

(4) By sum of bottom and sides, directly measured, 71,266.

Mean of all, 71,250.

This number is verified in still another way: The beautifully polished granite stones, composing the walls of the King's Chamber, are one hundred in number, arranged in five tiers. These stones are so exquisitely fitted that their dimensions may be recovered within a few hundredths of an inch; and yet, so fine are the joints that a distinguished observer, Lord Lindsay, in 1838, failed to detect them and reported that the polished slabs were continuous from floor to ceiling. The four upper courses are all of equal height, but the lowest course is hidden by nearly one-tenth of its height by being submerged to that extent below the level of the floor; and this was done intentionally so that the cubical contents of the

room, included by this lowest tier of stones, should be exactly 50 coffers. If Smyth's value is correct, we have here the origin of the British pint, namely, 1 Coffer = 2500 pints, with a further suggestion that the pyramid system of weights and measures made use of the numbers 5 and 10 as ratios for subdivision into subordinate parts.

In like manner we find a duplicature of the standard of length; for, as the sacred cubit is designated and measured by the eccentricity of the niche in the east wall of the Queen's Chamber, so the inch is given by the eccentric displacement of the knob of the hanging leaf of the entrance of the intermediate "chamber of the key." Moreover, this knob projects just 1 inch and is 5 inches broad. The uniqueness of these features—the niche and the knob—and their being both eccentric, stamps them as having something in common, and since we find that the distances thus forced upon our attention are commensurate with the Earth's axis, we may conclude that their extraordinary astronomical and geodetical import has been purposely emphasized by the astronomical architects.

FURTHER APPLICATION OF THE "KEY"

Of the key-length, 116.26 pyr. inches, on the floor of the antechamber, 103.03 inches are of granite. The total number, "116.260," Captain Tracy pointed out, "is the diameter of a circle having precisely equal area (up to its last figure at least) to a square of 103.033 in the side." (Smyth, p. 141.) The granite length is also one-half the breadth of the King's Chamber, besides which we have the following relations:

(1) $103.033 \times 5 = 515.165 =$ cubic diagonal of King's Chamber in pyr. inches.

(2) 103.033×50 (the number of the masonry course on which the chamber stands) $= 5151.65 =$ side of square of same area as the pyramid's vertical central meridian section.

(3) $116.260 \times 2 = 232.520$ = mean of inside and outside height of the chamber wall (nearly).

(4) $116.260 \times \pi = 365.242$ = days in tropical year.

(5) $116.260 \times \pi \times 5 \times 5 = 9131.05$ = basal side of pyramid at the mean socket level.

(6) $116.260 \times 50 = 5813.0$ = vertical height of pyramid above the mean socket level.

With the granite key-number as a divisor, and with corrections of only a few hundredths of an inch in the measured dimensions, corrections which seem perfectly admissible, since evidences of earthquakes which have broken some of the stones are present, Mr. James Simpson brings out these notable relations for the King's Chamber:

Breadth	2.000,	Square =	4
Inner height	2.236,	Square =	5
Length	4.000,	Square =	16

Sum = 25

End diagonal	3.000,	Square =	9
Floor diagonal	4.472,	Square =	20
Side diagonal	4.582,	Square =	21

Sum = 50

Solid diagonal	5.000,	Square =	25
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$25 + 50 + 25 = 100$, or the same number as the "blocks of well-cut, squared, polished, and evenly heightened, though very differently lengthed, granite." (Smyth, p. 135.)

Moreover, if the chamber's length = 412.132 be multiplied by 5×5 , we get 10303.29+ or 100 times the cabalistic granite key-number. (*Ibid.*, p. 138.) The thing begins to look positively uncanny, and if this is an example of Egyptian "magic," we may well ask what further intricacies are involved in some of the still unknown symbols. The number *five* is pre-eminently the pyramid number, since its solid figure has five

solid angles and five faces; but the numbers three, four, and even are also especially emphasized, as we have seen, and these are the numbers of greatest spiritual significance.

As we have seen, Proctor assumed that the entrance passage was constructed at the time when α *Draconis* had the altitude of the passage and by continual reference to the star; but the quotations given above prove that the construction was finished centuries before this time. Moreover, since it was no doubt built in the day time, a ray of sunlight reflected by a mirror through a pair of apertures defining the adopted angle Θ , would be much better than the star as a working standard.

The actual angle, $\Theta = 26^\circ 27'$, and not the ideal angle, $\Theta = 26^\circ 9' 7''$, determined the date of Papi's observation, which must have been made at 3430 B.C., according to the computation of Dr. Lowell, after correction for refraction. This is a very necessary precaution, attempted by Proctor, who, however, applied his correction with the wrong sign! This date must have been also that of the foundation of the temple of Denderah.

Petrie thought from the inscriptions that the reign of Papi must have been within 60 years of 3240 B.C. Maspero believed that it was about four centuries earlier. (Dawn of Civilization, Ft. note to p. 423.) The relation of the temple to the pyramid decides in favor of an intermediate date, for which Lowell's value may be adopted.

Maspero also (p. 364) states that Khufui "restored the temple of Hathor at Denderah"; apparently misunderstanding the instructions left by Khufui for its *erection* at the subsequent date.

At the time of Khufui 800 years earlier than this, the star *Draconis* must have been $\frac{800 \times 18''}{3600} = 4^\circ$ farther from

the pole than in Papi's time, but it could still have been observed by the aid of suitable screens in the outer part of the entrance passage of the pyramid. Such a screen was apparently used in Papi's day for comparing the upper and lower culminations of the star, since, precisely at the right distance from the mouth of the entrance passage are vertical lines ruled "as by a master hand" on the walls on either side, just where a screen must have been placed to include both culminations. (Proctor, p. 112.) Various mystical meanings have been assigned to these lines, but the mystery vanished as soon as Proctor* pointed out their obvious astronomical use.

We have arrived at the conclusion from the best available evidence that the temple of the "Mother of God" (name used by the Egyptians long before it was taken up by the Roman Church) was erected at Denderah by Papi I of the VI Dynasty 34 centuries B.C., at the time when α *Draconis* was shining centrally down the entrance shaft of the Great Pyramid, thus being the signal appointed by Khufui for the building of the temple of profound astronomical and religious significance. On p. 68 (The Book of the Master), Mr. Adams says that at the time, "the star's true distance from the pole was $3^{\circ} 53'$; and $3^{\circ} 53'$ is the meridional distance between the temple of Denderah and the Great Pyramid." But we have seen that $3^{\circ} 53'$ was not the star's true polar distance, either in Khufui's time or in Papi's. Lowell takes $3^{\circ} 34'$ from Smyth's measure of the angle of the entrance passage only. If the mean of all the passages is preferred, $9'$ must be added to this angle, which would set the date back thirty years.

* I note in passing some discrepancies in Proctor. On p. 5 for polar distance of α *Draconis* = $3^{\circ} 42'$, from Smyth's value for the mean of all the passages, Proctor gives the pair of dates 3440 and 2160 B. C. But on p. 100, with the same polar distance he names these dates: 3350 and 2170 B. C. Lowell's correct values are (for true polar distance = $3^{\circ} 34'$): 3430 and 2150 years B. C. (*Popular Science Monthly*, Apr. 1912, p. 456.)

have shown that the latitude of Denderah was probably obtained in a different way.

The plan upon which Papi religiously carried out the ancient design did not originate in his own mind, but was brought to light by him from a crypt or secret chamber, being written "in archaic characters," say the records, by Khufu himself, the astronomer-architect of the Fourth Dynasty, and buried by him in the spot eight hundred years before the days of Papi. (Adams, p. 65.) The inscriptions recount how Thotmes III (more than 1500 years before the time of Christ) gave command to rebuild the temple according to the ancient design, so that at that period the plan was already reckoned as antique. (Adams, pp. 64-65, quoting Dumichen.)

The Egyptian goddess, Athor, or Hathor (Mother or "habitation" of Horus), is so closely identified with Isis, the wife of Osiris, that they are obviously meant for the same individual. Denderah, the ancient Tentyris, is surmised by Sir Gardner Wilkinson (*Manners and Customs of the Ancient Egyptians*, Vol. III, p. 117) to have had its name corrupted from "the abode of Athor," Tei-n-athor, to Tynatyr, and at length to Tentyra. Here Hathor is supreme. Her name takes precedence in the inscriptions, though elsewhere relegated to a subordinate place. The temple itself is ostensibly a stellar shrine. On its great ceiling, carved in stone, the constellations of the zodiac march in procession. There we see Orion (Sahu) leading Sirius (Sothis) in their boats. There we find Osiris and Horus in the form of birds adoring the sun, for the inmost thought in the Word concerns only the divine. If astronomy is pre-eminent in this structure, it is for the sake of the things symbolized by the starry heavens.

To name only a few of the prominent astronomical features of the temple, let it be noted that the name "place of the orbit" refers to the orbit of our Earth, whose position gives the key to all the varying aspects of the universe. From that orbit, the line of the Pharaohs derived one of their

proudest titles, "Neb Sennen," Lord of the orbit, proclaiming at once the universality and the endurance of their dominion; and from it the Initiate in the Egyptian Ritual obtained his illumination in celestial things. That motion is invested in no slight degree with the serenity of the heavens; and no natural image is fraught with greater radiance or tranquillity than that of the rolling year as it circles perpetually about the feet of God (Adams, pp. 27-28.)

The Egyptian kings inscribed their names (cartouches or Champollion) in an oval with a straight line tangent at the end of the longer axis, ordinarily supposed to represent a signet ring, but perhaps denoting the Earth's orbit and testifying to the fact that at the time of the adoption of this device, node and perihelion coincided.

The great significance attached to the Earth's orbit by the Egyptians is also shown by their erection of a four-faced pillar at Philæ to define what was at that time the northern tropical limit.

The orbit also stands for the yearly period which in Egypt consisted of twelve equal months, each of three decades of days, or three seasons, each of twelve decades of days, and a sacred interval of five days. The decades, "each headed by a solar snake," denoting the sinusoid curve of the sun's change in declination, are shown on the walls of the temple of Denderah. The sacred interval of Jubilee, or "time of praise," took place at midsummer at the beginning of the inundation of the Nile and of the sacred year, its five birthdays assigned successively to Osiris, Horus, Seb, Isis, and Neith. On the day after the close of the sacred interval, the new year opened with the first of the month Thoth.

According to Maspero (*Dawn of Civilization*, p. 370) "the Great Pyramid was called Khuit, the 'Horizon,'" which he explains as meaning that in it "Khufui had to be swallowed up, as his father the Sun was engulfed every evening in the

horizon of the west." This is of course on the tomb theory. Mr. Adams gives a more rational explanation:

If we turn to the sacred texts of Egypt, and compare them with this sacred monument, we find them to be full of allusions to astronomical conceptions, and more particularly to what is called in the papyri the "Horizon of Heaven,"—a circle evidently entirely different from what we mean in speaking of the celestial horizon of any given locality, and occupying a definite and important position in the universal sphere. (Adams, p. 55.)

In fact it is no other than the solstitial colure, or "great circle forming the celestial horizon of an observer stationed on the equator, and having in his zenith the point of equinox," and which was defined at noon or midnight in midsummer by the plane of the Great Pyramid passage passing through the pole-star and the point overhead. Actually, the entrance passage has over its door the hieroglyphic label, "Horizon of Heaven," a rectangle having at the center of its upper and longer edge a semi-circular notch, doubtless intended to suggest the setting sun, and presumably the "name" mentioned by Maspero. Mr. Adams describes his amazement on visiting the pyramid in finding this confirmation of his theory, and speaks of it as the only hieroglyph on the structure, but possibly there are others. A further confirmation of this astronomical theory might be drawn from the fact that the epoch of midsummer is noted and emphasized in the following way: At the winter solstice, the highest point of the roof of the Grand Gallery falls on the lowest, or most northern point of its floor, but comes at midsummer barely within the southern limit of that floor. This was noted by Proctor; and Lowell, who repeats the calculation, finds that the length of the floor at the given inclination exactly subtends the track of the shadow from winter to summer.

Still other astronomical events are recorded in the various temples of Egypt. Thus

if we calculate the position which would be occupied by the moon at the epoch of the opening of the Kalendar, when at the farthest distance from the ecliptic compatible with eclipse, it will be found to be vertical in the latitude of Luxor. And what is even more remarkable, as relating to an epoch long antecedent to the foundation of the Kalendar, the farthest limit ever attained by the sun through the variation of the ecliptic (according to the calculations published by the Smithsonian Institution) is about $24^{\circ} 33'$; and that latitude is marked by the venerable temple of Ombos. (Adams, pp. 57-58.)

At Denderah, "on one side of the vast entrance hall, or 'Khent,' the walls are covered with a representation of the fourteen ascents of the moon, leading up on the fifteenth to the throne of Thoth, the Lord of Measurement, and corresponding to the number of days between new and full moon." (Adams, p. 70.) On the opposite side are the eighteen solar boats of the decades of the half year, already mentioned.

And in the area of the same entrance-hall rise eighteen enormous columns, divided into three rows, each containing six columns, therefore, in the "Habitation of Horus," and to the foundation of the building at midnight, as the records relate, it would seem that allusion is made when we read in the papyrus of Ani, of "the night of setting up the columns of Horus and making him to be established as heir to the things which belonged to his father." (Adams, pp. 70-71.)

The Great Pyramid also has its lunar science and significance, though as a subordinate feature. On the eastern wall of the "Queen's Chamber" (may we not say that "fair Luna" is the queen in question?) is a five-stepped niche which apparently served both a metrological and an astronomical purpose, for the niche is displaced by exactly one sacred cubit of 25 pyramid inches, as if to define this unit of length, which, again, the chamber does in another way, since it stands on the twenty-fifth course of masonry. The five steps ascending and five descending also suggest the number five times five. The lunar significance is found in the fact that the Moon's

orbit is inclined about 5° to the Earth's orbit and crosses the ecliptic twice in each month, "so the motion of the moon relatively to the earth may be represented by a series of five ascents and descents, each of one degree." (Adams, p. 193.)

The pure white marble of the passage leading to the chamber, as well as that of the Grand Gallery and the walls of the chamber itself (this stone being of marine origin, that is, formed under water) suggests that, like the Moon, this feature of the pyramid spiritually symbolizes faith. Its twice five steps may stand for the decalogue, for the Ancient Church had the laws of life long before Sinai, which merely reinforced them. Similarly, the red granite of the higher chamber (granite being a rock formed through the agency of fire in the heart of the earth) speaks in spiritual language of love and suggests that the upper chamber, the abode of the sun, denotes love. Over its door are four vertical grooves. Of the obstructions which they may once have held, only the hanging leaf remains. The relative importance which the Egyptian religion gave to love and faith is indicated by their making the cubical contents of the abode of love 20,000,000 cubic inches (nearly), while the place assigned to faith has only about 10,000,000. This is ten to the seventh power. The faith is still one that concerns holy things. The number seven is also explicitly given in the approach to the sacred chamber of faith, for the last seventh of its length is deepened by one-half, as if the passage represented the week with its Sabbath, the week being the nearest approximation to the fourth of a lunar month.

The cubical contents of the chamber may also have been intended to have a metrological connection with the sacred cubit by noting its relation to the radius of the Earth, the cubit being the ten millionth part of that distance; but the consummation of the idea does not seem to have been exact.

The multiple metrological and astronomical significatives

concealed in this stone cryptograph and noted above, are certainly so closely fulfilled that there can scarcely be a doubt as to their being intentional. The argument for a corresponding dual significance of natural and spiritual meanings finds its support in many passages in the Book of the Master of the Secret House. Not only can there be no possible objection to this association of the two most memorable things of ancient Egypt, but remembering that all holiness resides in ultimates there is an enhanced value in this connection of things of earth with those of heaven.

It has been suggested that the Grand Gallery, with the several overlappings of the stones of its walls, has a spiritual significance and represents the New Jerusalem. Its cubical contents are 36,000,000 cubic inches, one million to each of the thirty-six stones of its roof. Astronomically, these thirty-six stones stand for thirty-six decades of days in the circuit of the sun or year. Considered as symbols, taking the furlong as 300 cubits, the measure of the Holy City (12,000 furlongs) is equal to 3,600,000 cubits. In correspondences, however, it is not the linear dimension that signifies, but the correspondence is in the number. Swedenborg says: "On any other ground what would it mean, that the height of the city was twelve thousand furlongs, thus rising immensely above the clouds?" (*Apocalypse Revealed*, n. 907.)

To some these significatives may seem far fetched, but remembering that there are no written legends on the pyramid such means as these are the only ones by which the building can speak to us; and in this respect it stands on a level with nature itself, where in nature's great stone book, those who have the open eye can read the history of creation.

But are there absolutely no other signs recorded on the walls of this building from which meanings may be drawn? I think that there are; for over the entrance are two large stones

forming a gable, or an inverted V , and over these are two more of somewhat larger size, the structure serving to relieve the pressure of the overlying masonry on the triangular horizontal stone which forms the lintel of the entrance and bears the hieroglyphic for "the horizon." Since, however, these stones are near the outer sloping surface, there is very little superincumbent weight, and the structure is not really necessary as an architectural precaution, because the slant thrust is comparatively small.

Now let it be noted that the figure formed by the *entrance* stones is one of several modes of writing the first letter of the alphabet in the hieroglyphics. (See Fig. 22 on the fifteenth page of my article: "Science in Religious Instruction." *New-Church Review*, Vol. vii, 1900.)

The inverted V is believed to represent the horns of a bull. It is the first letter in "Ah," the name of the bull-calf, onomatopoeitic for the animal's voice. The symbol might also stand for the legs of a man. In either case it denotes power.

At the opposite end of the interior passage of the pyramid, in the antechamber where the Grand Gallery ends and just before the majestic "King's" chamber is reached, is the hanging leaf of granite bearing a raised curved boss which resembles the Greek letter Ω , itself derived in all probability from the *crux ansata*, or symbol of life. The cross was the most sacred symbol of the Ancient Church. It is held out to the devotees by the symbolic figures of their worship, because in it was Life.

The prophecy of the Incarnation was given near the beginning of the Ancient Word and was incorporated in the opening book of the Israelitish Word in order to connect the former revelation with the newer, whence also Moses became the son of Pharaoh's daughter (Exodus ii, 10) and was learned in all the wisdom of the Egyptians. Here we have all that is neces-

sary to interpret the spiritual symbolism of the "Secret House, the "Light" of Egypt.

"I am the Alpha and the Omega, the beginning and the end, the first and the last." (Apoc. xxii, 13.) The message to the Ancient Church and that to the New Church alike bear the divine signature. Surely we must be approaching first sources in the Ancient Word.

If we seek further we shall find other evidences of a direct connection with the source of wisdom in a revelation of spiritual truth in this wonderful building. Within the pyramid are three chambers at different levels. The inner or highest—the most majestic of all—beautifully lined with red polished granite, containing in the same material a replica, or rather we should say the original model of the Ark of the Covenant typifying the Divine Love, or its receptacle the Celestial Heaven. The middle, white-walled chamber represents the Divine Wisdom, or its habitation the Spiritual Heaven. The subterranean chamber, cut out of the common rock of the hill and unfinished, is the ultimate of Divine Creation in nature, or the natural life of man. The descending passage ends here, but reappears for a short distance on the other side of the chamber, ending however, in a cul-de-sac. As far as humanity goes, there is no way out. The descent of man has ended in disaster. "I beheld the earth, and lo, it was without form and void; and the heavens, and they had no light. I beheld, and lo, there was no man, and all the birds of the heavens were fled." (Jeremiah iv, 23, 25.)

The ascending passages of the pyramid, as finally left by the builders, were closed at the bottom, representing in spiritual symbolism the discrete degree which separates the heavenly world from nature. There is but one way left open, namely, the so-called "well," beginning a little above the subterranean chamber, and passing through the "grotto" (perhaps standing

For the intermediate World of Spirits) and ending at the foot of the Grand Gallery. If the divine meaning of the descent is the coming of the Lord as Savior into the world, and His following after the lost sheep, this well of ascent must signify the Glorification of His Human and the Redemption of Mankind. By the path of regeneration, we are to follow Him. The footholds cut in the sides and the painfulness of the ascent, are the steps of progression in the regenerate life. Man wonders why all this toil is necessary; why immediate access to those heaven-symbolizing ascending passages could not have been given. But that door is closed, that a more wonderful lesson of the infinitude of the Divine Love and Mercy be given.

But a still more direct exemplification of the hidden Messianic meaning of these ancient structures may be obtained from the temple of Denderah. I will let Mr. Adams describe this.

In the center of the temple is the hall of the Altar, with entrances opening east and west; and beyond it lies the great hall of the temple, entitled the "Hall of the Child in his Cradle," from whence access is obtained to the secret and sealed shrine entered once a year by the high-priest, on the night of midsummer. From that shrine the image of the holy Mother was on that night conveyed by the priests in procession up a secret staircase to an open chamber on the roof, there to hold communion with her divine father Ra. And upon the walls is depicted the figure of the Virgin Mother with the rays of the divine splendor streaming from the circle of her womb, forcibly recalling the striking vision of the prophet Ezekiel, when he beheld a "great cloud coming up from the North," and the "splendor within the circle," and "the fire enwrapping," and the "amber in the midst of the fire,"—the sacred Mother retaining her virgin purity transparent as amber in the midst of her fiery espousals, and surrounded by the great cloud of the "heavenly host" coming up from Nazareth in the north of the Holy Land to the place of birth, bearing the Eternal Splendor in her womb. (Adams, pp. 71-72.)

Another feature of the temple which is no longer there, having been transferred to Paris early in the Nineteenth Century, is the wall painting which represents the starry heavens: "In the space between the circle and the square rim is depicted at each of the four principal points [the four quarters of the heavens—the four aspects of the New Jerusalem] in a double form, the divine Horus, the child of Hathor, Queen of the starry universe. . . . Midway between each quarter is the figure of the holy Mother." Around the border is an inscription which is thus translated by Mr. Adams, possibly for the first time:

Turning point of the circles of light. Head of the circles of Annu (Denderah); Horus, Entrance of the Golden Heaven, Seat of Sacred Dances in the six Heights of Horus, Son of Osiris.

Palace chamber of Height of Holy Adoration; Palace chamber of Height of Light.

Ahi, Lord of the Palace Chamber, Height of the Hour of living Osiris, Burning Height of priestess of Holy Moon.

Chief of the Southern Splendor.

Meeting-place, Region of Gods. Head of nurse of Ra. Living Breath of the waters of passage of the double hour.

Heavenly Flame of Burning Gold.

Golden Heaven of Isis.

Horizon of Light.

The Great One of the Lady Mother.

With this evidence before us, need we hesitate to acknowledge that here we have, in symbolic form, the prophecies given to the Ancient Church of the Coming of the Savior? It was inevitable that Isis, as the wife of Osiris, should have her place assigned in the house of the Master. In the pyramid, the Grand Gallery (the "Double Hall of Truth" of the Ritual) represents the house of Isis with the Throne of Judgment at its head. Its thirty-six roofing stones—six times six—are the fulness of conquest over the temptations of life. The Church, true and tried, rises to the embrace of her Lord in the "Palace

Chamber of Height of Light," the "Golden Heaven of Isis." The splendor of this imagery, as well as the multifariousness of the legendary lore of Egypt, flows from the inexhaustible character of the resources of spiritual truth.

As one of her numerous symbolisms, Isis may have prefigured Mary, the Mother. Not that, literally, Isis *meant* Mary, but as representing the Church, one of her functions was to receive and embrace her Divine Lord. Some of the early Christians thought that they recognized the identity of Mary-Isis, and though, as an individual human being no special sanctity attaches to the person of Mary, she stands in the Word for the true church—the Bride of the Lamb. To Mary herself, now an angel, anything like Mariolatry would be unutterably repugnant. Swedenborg says:

Once I was permitted to speak with Mary, the mother. She passed by at one time, and appeared in heaven above my head, with a white robe like silk; and then pausing a little, she said she had been the mother of the Lord who was born of her; but that He, having become God, had put off all the humanity derived from her, and she therefore worshiped Him as her God, and did not wish anyone to acknowledge Him as her son, because all the Divine is in Him. (*True Christian Religion*, n. 102.)

We are told (*Heavenly Arcana*, n. 260, and elsewhere) that it was known to the Ancient Church that the Lord was to come into the world, and that Egypt was one of the lands where that Church held sway. How intimate this knowledge was, may be gathered from the foregoing. I would refer to Mr. Odhner's beautiful book, "The Correspondences of Egypt," for further evidence that the mysterious legends of the gods of Egypt were nothing else than symbolic narrations of the truths of the Ancient Word, repeated in multifarious forms, but always with the intention that they should be read spiritually by those prepared to receive them, while remaining closed books to such as were not ready to be uplifted to their

level. Let us rejoice that now once more the highway out of Egypt, through Assyria, into the Holy Land has been opened.

THE PRIEST-ASTRONOMERS OF EGYPT. THE CORRUPTION OF
THEIR CHURCH AND THE DECADENCE OF THEIR SCIENCE

Every Church heretofore has had its Fall, involving the corruption of its morals, the desecration and loss of its wisdom, and its final judgment and dissolution. Egypt's science degenerated into magic and necromancy. Its religion became idolatry and priestcraft. The ancient formulæ were still observed but their meaning was obscured or forgotten. We must return to the more ancient sources to find them in their purity.

Great stone images of man-headed winged bulls or lions stood at the entrances of Assyrian palaces and temples. These were not worshiped but were wholly symbolic, as were the avenues of sphynxes in Egypt. The bull and the lion occur repeatedly in the Word with the spiritual correspondence of power, even of divine power; and as cherubic images there was no danger of mistaking them for the things they signified. But when in Egypt this symbolism degenerated into the worship of animals, the symbols were hopelessly perverted. Dean Stanley thus describes the deification and mummification of a long succession of bulls:

Long galleries, hewn in the rock and opening from time to time—say every fifty yards—into high-arched vaults, under each of which reposes the most magnificent black marble sarcophagus that can be conceived—a chamber rather than a coffin—smooth and sculptured within and without; grander by far than ever the granite sarcophagi of the Theban king,—how much grander than any human sepulchres anywhere else! And all for the successive corpses of the bull Apis! (*Sinai and Palestine*, p. lii.)

The material grandeur increased as the Ages progressed, but *pari passu* the spiritual conception deteriorated and became successively pantheistic, materialistic, and gross.

Of the early Egyptian architecture, Mr. Ferguson says:

No one can possibly examine the interior of the Great Pyramid without being struck with astonishment at the wonderful mechanical skill displayed in its construction. The immense blocks of granite brought from Syene—a distance of 500 miles—polished like glass and so fitted that the joints can hardly be detected. Nothing can be more wonderful than the extraordinary amount of knowledge displayed in the construction of the discharging chambers over the roof of the principal apartment, in the alignment of the sloping galleries, in the provision of ventilating shafts, and in all the wonderful contrivances of the structure. All these, too, are carried out with such precision that, notwithstanding the superincumbent weight, no settlement in any part can be detected to the extent of an appreciable fraction of an inch. Nothing more perfect, mechanically, has ever been erected since that time.

This is the testimony of an expert in architecture.

We have learned with certainty that over 6,000 years ago structures of surpassing grandeur had been built, and of a mechanical perfection which has never been equaled, or approached, from that day to this. Moreover certain astronomical facts of very great importance had been learned by careful observation with superb instruments; and for accuracy these astronomical data had not been equaled until within less than a half century ago. We should be prepared, then, to learn that there were wise men in Egypt, whose spiritual wisdom far exceeded our own, however much it may have been obscured and lost by a subsequent deterioration. A large part of our present knowledge of ancient Egypt concerns these ages of decadence.

The temple of Hathor at Denderah, as it now stands, is a more recent, though still a very ancient rebuilding of an older building on the original site. The astronomer Biot demonstrated in 1844 that the sculptured circular planisphere of the stars, done in stone, represents a grouping of the circumpolar

stars around the north pole at about 700 B.C., as determined by precessional changes, thus fixing the time of the design according to which the repairs were made, even though the unfinished work may not have been completed until long afterwards in the times of the Roman emperors by men who evidently did not consult the heavens. Lockyer also obtains the same date from the amplitude of the axis of the adjoined sanctuary of Isis, pointing to the place on the horizon where Sirius, the star of Isis, rose at that time. Biot also showed that the time of year at the rededication of the temple of Hathor must have been the summer solstice, and the hour, midnight. Thus, in every respect, the circumstances at the refounding of the temple were such as to recall its ancient foundation, and its emphasis of the solstitial colure, although the stellar conditions associated with the original dedication had long since departed.

The constellation figures depicted on the ceiling at Denderah can be traced back to at least 1,000 years before this, or to the time of the Eighteenth Dynasty. But even this does not bring us to their origin; for, just as the stellar pictures at Denderah record a condition of the heavens earlier than the date of completion of the temple, so the constellations of the Ramesseum—especially the placing of the vernal equinox in the constellation of the Bull,—refer, not to the date of that building, but to 3285 B.C., as determined by Biot from astronomical considerations alone. Since the Ramesseum was an equinoctial temple, that is, one whose astronomical significance was related to the equinox, and not, like Denderah, to the solstice, we learn from this celebration of an astronomical event, ages afterward, that for some reason which is now a matter of speculation, the Egyptians attached a special importance to the entrance of the equinox into the constellation of the Bull.

The zodiacal constellations on the "square" zodiac a

Denderah are the same as our own, and were of Babylonian origin. The Lion, as an astronomical symbol, may stand for the heat of summer, and it appears to be significant of the date when the names were assigned that the sun at the summer solstice was in the constellation Leo, at the date when the spring equinox was in the constellation Taurus; while, at the winter solstice (or at the season of winter rains in north temperate regions) the sun was in the Constellation Aquarius. Lockyer in his "Dawn of Astronomy" (pp. 463-464) quotes Jensen ("Cosmologie der Babylonier") in his attempt to explain the Babylonian signs of the Zodiac: Marduk, "god of light, and vanquisher of Tiamat, *i.e.*, the ocean, has for a symbol the Bull = Taurus, into which he entered in spring."

In Babylon as in Egypt, the ancient correspondential wisdom was turned into fable, and science too became more or less mythical. Astronomy was turned into poetry.

Sir Norman Lockyer (in the work cited, p. 278) has some interesting remarks on Calendar revision in Egypt. Only three seasons were known in Egypt—the three "tetramenes": First tetramene, Flood-time, represented in hieroglyphics by the descending rays of the sun and the crenulation, thrice repeated, of the rippling waters. Months: Thoth, Phaophi, Athyr, Choiach.

Second tetramene: Seed-time, hieroglyphically, a field with heads of growing grain. Months: Tybi, Menchir, Phameroth, Pharmuti.

Third tetramene: Harvest-time, represented by what is meant for a barn. Months: Pachons, Payni, Epiphi, Messori.

This is the original arrangement and the first of the month Thoth primarily coincided with the summer solstice and the beginning of the rise of the Nile. This, however, could only have been exact at some one point in the land, since the flood took over two weeks in passing from south to north.

The coincidence of the first of Thoth in the common, or "vague," and the sacerdotal years, began the Sothic cycle of 1461 years, first used, according to Oppolzer, in the year 4235-4236 B.C.

Lockyer adduces some evidence of several "calendar reforms." The cycle, according to him, did not always assign the first of Thoth at its beginning to the commencement of the inundation. He also suggests that there may have been a previous Texic cycle, given by the heliacal rising of the star Texi (α Urs. Maj.?) though this must have been soon abandoned, because the star is not suitable.

After Thoth was transferred to the second tetramene, there were three cycles of this new, modified form, whose dates of beginning, according to Lockyer (p. 269), were 3192 B.C., 1728 B.C., 270 B.C. Discrepancies, however, still remain and Lockyer is obliged to infer that there were yet other transfers of the first of Thoth. There is, indeed, historical evidence for some such change.

After the last "reform" (decree of Janis in 238 B.C.) the cycle was supposed to begin with the month Pachons, instead of Thoth. The argument is thus given by Lockyer who explains the difference of four centuries between his system and Oppolzer's as follows: The first of Thoth (vague year) occurred in 23 A.D., on August 29; in 139 A.D., on July 20; in 238 A.D., on June 25. The final reform brought the Sothic period of 270 B.C. (Lockyer's date) into conformity with a revised calendar at 239 B.C. through the following relation:

Difference 270 — 239 years =	31 years
4×3 months = 4×90 days advances	360 years
4×5 epacts =	20 years
	<hr/>
Sum =	411 years

Now Censorius made the true Sothic period end in 139 A.D., or 409 years later than Lockyer's calculation for the revised cycle, which gave 270 B.C. Consequently Lockyer assumes that this difference was eliminated by special decree.

If we take the original cycle and assume that, no matter how much the civil authorities may have been mixed up in regard to the truth of the matter, the priests still retained their secret and sacerdotal year, we get the genuine Sothic cycle, continuous from the time of Khufui, as computed by Oppolzer (quoted by Lockyer, p. 268): Beginning of successive Sothic periods.

0	1	2	3	4	5	
-4235	-2774	-1316	+139	+1591	+3039	Astronomical
						Reckoning Intervals: 1461 1468 1455 1452 1438 years.

These are the astronomical dates in Julian year intervals. The subject is somewhat complicated. There are discrepancies between the different computers. Thus Oppolzer gives for the close of the first cycle from Khufui, 2775 B.C.; Lockyer, 3192 B.C.; Biot, 3285 B.C.; all referring to the same event. The discrepancies arise from differences in the authors' conceptions as to what is meant by "heliacal rising." If the Egyptians used long dark passages pointing to the place on the horizon where the star rose, the observation could have been made just as the sun was rising. Otherwise the sun must have been about 10' below the horizon in order that the star could be seen against the dawn sky. To this is added some further uncertainty as to whether a Thoth or Pachons cycle is intended.

The following dates are probably more reliable, as they are independent of the Sothic cycle, and relate merely to the position (amplitude) of the axis in temples which presumably were used for just this purpose of observing the rising of Sothis simultaneously with that of the sun. The declination of the

star and the consequent date of the observation are computed from the observed amplitude of the temple. There will necessarily be a variation in the time of rising if the horizon is obstructed by hills. These are allowed for in Lockyer's calculation.

Sothic Temples

Temple	Hills	Amplitude	Declination	Year B.C.
Karnak (O)	1°	E. 26° ½ S.	23° ½	3150
Der-el-Bahari	1°	24° ½	21° ¾	2700
Dosche	1°	21° ½	19° ¾	2050
Karnak (D)	1°	21° ½	19°	1800
Naga (G)	1°	19°	18°	1400
Philæ (Ethiopian) ..	2°	19° ½	17° ½	800
Denderah, N. W. Temple ..	0°	18° ½	16° ¾	700

The star Sirius (Egyptian Sept, or in its Greek form, Sothis) was exceptionally fitted for a precessional standard, since its declination changed only a few degrees in several thousand years, on account of precession; and this must have been known to the originators of the Sothic cycle, which itself indicates that they had a very full knowledge of the entire subject of precession.

The precessional movement of Sirius almost exactly made up the difference between the true length of the year and the assumed length of 365 ¼ days. (Lockyer, p. 256.)

The earlier dates of the age of the pyramids are more certainly known than some of the more recent ones. If the Egyptians had only stuck to their Sothic cycle consistently, the case would have been simpler. For all this we may blame the Egyptian priests, who knew perfectly well what was the true length of the year and the correct date, but who kept this knowledge to themselves for the sake of retaining their power

over the civil government. Correct time-keeping is one of those intangible things the existence of which we scarcely realize so long as all goes well, and its importance is liable to be underrated by the unthinking; but nevertheless it is one of the essentials of civilization. Yet most people, even the majority of *educated people*, have only a vague idea of how the thing is accomplished. Thus the priesthood of Egypt easily retained its control through a special astronomical knowledge. Nowadays, the trick is done in a different manner by means of complicated systems of accounts, and complex legal fictions, which can only be untangled by financial and legal experts, who inculcate an exaggerated respect for "law," on which politics is based. For instance, a world-finance purports to be founded on the "gold standard," which is a legal fiction. It is known that there is not enough gold in the world to finance more than a part of the world's business operations, so resort is made to a mysterious thing called "credit," somewhat as current scientific opinion is based on a mysterious "proton" on which I have before remarked. The result is enormous national debts, disputes about refunding, risky inflation of paper currency, "the Dawes' plan," etc.

As the Ancient Church of Egypt sank into decay and death, its once clear light burdened with an absurd ritual and an irrational fantasy, became "Egyptian darkness." Just so, the Christian Church sank to its death in a false doctrine and a perverted morality, until the climax was reached when, in the middle of the Eighteenth Century of our Era, "the abomination of desolation foretold by Daniel the prophet" appeared. To realize this, one should read Edwin Markham's paper: "Swedenborg, the Eye of the Age," in the *New-Church Review* for April, 1925. (Also printed separately.)

The Ancient Church of Egypt was full of enigmas, but they were not placed there to puzzle and delude, though they

became delusions when men ceased to think spiritually. The images and imagery were given originally to make men think and perceive spiritual things. Much the same has happened in the Christian Church. The glorious Apocalyptic vision of the sounding of the trumpet of the seventh angel: "The kingdoms of the world are become our Lord's and His Christ's" have been misunderstood. That little word "*and*" has been a stumbling block. The literalists, who call themselves "Fundamentalists," point to it triumphantly: Two persons are named and meant, say they. Some natural scientists say so too. But the two are one and the same—our Lord Jehovah-Jesus in His Christ-manifestation. "And He [not they] shall reign for ever and ever." (Apoc. xi, 15.) "Without a parable spake He not unto them." The parables of the Word of both Old and New Testaments are there, like the imagery of the Ancient Church, *to make men think*. The Church of the Lord's Second Coming is in one sense a restoration of the Ancient Church. But it is also a *New Church*, ("Behold I make all things new") in that *now* the reasons for the imagery and for the previous concealment are revealed.

Let us examine some of the ancient wisdom now restored. It is genuine spiritual science.

We have learned through Swedenborg, that Egypt in the language of parable stands for science, and from the Word, that a blessing was spoken concerning Egypt. Therefore also Jesus was taken as a little child into that land, "that it might be fulfilled which was spoken by the Lord through the prophet, saying: "Out of Egypt did I call my son." (Matt. ii, 15.)

Swedenborg has not left us any continuous treatise concerning the Egyptian hieroglyphic wisdom, but from his scattered remarks we can learn his principle of interpretation. Two books are to be especially recommended: "The Correspondences of Egypt. A Study in the Theology of the Ancient Church,"

by C. Th. Odhner: The Academy Bookroom. Bryn Athyn, Pa., 1914.

"Isis and Osiris in the Book of Respirations. Prophecy in the Churches. In the Word, God with us. The revelation of Jesus Christ." By James John Garth Wilkinson, Fellow of the Royal Geographical Society: James Speirs, 1 Bloomsbury Street, London, 1899.

In the most ancient times, the science of correspondences was the science of sciences; and was so universal, that all their manuscripts and books were written by correspondences; the Book of Job . . . is full of correspondences. The hieroglyphics . . . and mythologies . . . were nothing else. All the rites and statutes of the Ancient and Israelitish Churches consisted of pure correspondences. . . . The Lord spoke by correspondences, because He spoke from His Divine; for what is from the Divine, falls, in nature, into such things as correspond to the Divine ones. (*The Doctrine of the New Jerusalem concerning the Sacred Scripture*, n. 20.)

When correspondences were turned into idolatry and magic, the knowledge of them was providentially obliterated. (*Ibid.*, n. 22.)

The reason why the knowledge of correspondences was not disclosed (to the first Christian Church) was that the Christians in the primitive Church were very simple . . . and after those times darkness covered the universal Christian world from the papal dominion . . . and after the Reformation they began to divide faith from charity, and to worship three gods. (*Ibid.*, n. 24.)

The comparison between Isis and Mary (ante, p. 113) must not be taken as in any sense a literal identification. Isis had many other symbolic meanings and her attributes included those of practically every other female divinity of Egypt. "Each goddess represented some specific affection or quality of Heaven and the Church, and Isis the 'myrionymus,' the goddess of ten thousand names, represents all these affections or heavenly qualities in one complex, thus Heaven itself, and the Church itself, as one whole." (Odhner, p. 121.) Hence among many other symbolisms, the prophecies concerning the

"Virgin Birth" had to be given to the Ancient Church as one of the mysteries of Isis.

In modern Christian Churches it is a general thing to call our Lord the Savior the Son of Mary, and rarely the Son of God unless they then understand a Son of God "born from eternity." The source of this is that the Roman Catholics have sanctified Mary above the rest, and have set her over all their saints as a goddess or queen; when yet the Lord, when He had glorified His Human, put off everything of His mother, and put on everything of the Father. . . . From this general thing in the mouth of all that He is called the Son of Mary, many enormities have inflowed into the Church . . . (which) are, that the idea of Divinity in relation to the Lord perishes, and, with this, all that which has been said in the Word concerning Him as the Son of God; then, that through this there enter Judaism, Arianism, Socinianism, Calvinism, such as this was in the beginning; and at last, naturalism; and with this, the frantic madness that He was the son of Mary by Joseph, and also that He had His soul from the mother. . . . Let everyone, both clergyman and layman, consider with himself as to whether he has conceived and cherished any other idea about the Lord, as the son of Mary, than as a mere man. (*True Christian Religion*, n. 94.)

It is believed that the Lord as to the Human not only has been, but also is the son of Mary; but in this the Christian world hallucinates. That He has been the son of Mary is true; but that He is so still is not true; for by the acts of Redemption He put off the human form from the mother, and put on the Human from the Father . . . (as) may be seen from this: That He Himself has never called Mary His mother . . . Thus did our Lord not call her "mother," but "woman;" and He gave her to John as a mother. In other places she is called His "mother;" but not from His own mouth. (*Ibid.*, n. 102.)

But Mary His mother afterwards represented the Church; and in this respect she is to be named His mother. (Canons IX, n. 8.)

In the Ancient Church:

Osiris was a prophetic representation of the Lord in His human, and Isis represents,—not His mother, but Heaven and the Church

conjoined with Him as His wife. Isis, it seems, was childless before the resurrection of Osiris, because there could not be a *complete* conjunction between the Church and the Lord until *after* the Glorification. Then, after her dead husband had been restored to life, she was united to Him, and as the result of their union she conceived her son, Horus, . . . who represents the Holy Spirit proceeding from the *Glorified* Human. (Odhner, p. 123.)

This reading, which may be said to give the larger aspects of the internal sense of the "Ancient Word" in what concerns the Church, does not prevent the figuring of Isis in other narratives to represent other parts of the long story of the "Fall" and the "Restoration" of the Church. Here, as in our Word, consistency and literal exactness is of less importance than faithfulness to the spirit of the narrative, which is its basis.

Swedenborg in his letter to the Royal Swedish Academy of Sciences said: "If it should be so desired, *I am willing to explain the Egyptian Hieroglyphics, which are nothing else than Correspondences, and to publish the explanation; nor can this be done by anyone else.*" This, at the time it was written, was literally true, and it remains true that whoever would learn the real meaning of the Egyptian mysteries must study correspondences.

Almost every Egyptian divinity carries the "*anch*" in one of his hands, while with the other he grasps the long staff or scepter, known as the "*tcham*." The rays proceeding from *Aten*, the god of the solar disk, terminate in hands, each of which extends an "*anch*" to the worshipers. The resurrected spirit is often represented as rising out of the sepulcher, holding an "*anch*" in each hand, and on his final entrance into "*Amenti*" or Heaven, the justified spirit is again presented with the "*anch*" and the staff, as the symbols of eternal life and spiritual power of progress and usefulness. (Odhner, p. 11.)

The anch
signifies life, and especially life after death, eternal life. . . .

The signification of the cross, as meaning temptation, suffering, and death, was known to the Ancient Church throughout the world, long before the crucifixion of the Lord made it the most sacred emblem of the Christian faith. Its very form suggests at once the idea of the self-will of man (the downward stroke) being broken by the level stroke of rational truth, the experience, when successful, resulting in the circle of eternal happiness. (Odhner, p. 13.)

Next to the "anch," the most common conventional symbol of the ancient Egyptians is the peculiar staff or scepter called "tcham" or "user," which every male divinity holds in his left hand. It consists of a long rod with two prongs at the nether end, and is surmounted with the head of a "cucupha," an unknown but evidently gentle animal whose ears terminate in a feather. The Egyptologists are unanimous in declaring that the back part of the ear represents a feather, and the whole, therefore, is a startling combination of the bird and beast forms. Birds with their wings and feathers signify intellectual things, doctrinals and truths, and the feather, as will be seen, was the universal emblem of *truth* among the Egyptians. Gentle beasts, on the other hand, represent affections and *goods*, and the handle of the staff, therefore, represents the conjunction of good and truth in ultimates.

A staff signifies the power and force of life from truth and good. In the original tongue a staff is so called from its being leaned upon and affording support, which, in the spiritual world is effected *through truth and good*. (Arcana, n. 9098.)

As a "rod" represents the power of truth, that is, the power of good through truth, kings carried scepters, and the scepters were formed like short rods; for kings represent the Lord as to truth, and the scepter signifies the power which they have, not through dignity, but through the *truth* which must command, and no other truth than that which is from *good*. (Ibid., n. 4876.)

The "tcham" scepter is often seen in combination with the "anch" and the "tet" or pillar of degrees, and a representation of *Thoth*, the scribe of the gods, shows this divinity holding a bowl, in which is seen the "anch" enclosed on each side by a staff. The staff represents the Divine Truth in ultimates and thus most especially the letter of the Word which *supports* the

internal sense and contains it in its fulness and *power*. The pillar of degrees, as shall be shown, represents the three degrees of the internal sense, and the "anch" signifies spiritual life. [The combination], therefore, represents the whole of the Word, with its life and spirit from good and truth, contained in their fulness and power in the sense of the letter. (Odhner, pp. 15-16.)

Osiris,—who represents the risen Lord in His glorified Human, judging "the quick and the dead,"—is often seen holding this [cucupha] staff in his two hands, together with the shepherd's crook and the flagellum or whip. The staff prophetically signified Him Who is the Word incarnate and glorified. The shepherd's crook stands for His priestly office, the power of Divine Good gently leading the justified to the rewards of heavenly life. And the flagellum or whip stands for His royal office, the power of Divine Truth, by which evil doers are punished and cast into hell.

The staff held by the female divinities is a stalk of the papyrus plant, from which paper was made in ancient times. This plant, therefore, became the symbol of *books*, and especially the sacred books of the Ancient Word. The ark of "bulrushes" (Exod. II, 3), in which the infant Moses was hidden, was made of the papyrus reed, and we may thus see why this ark represents the letter of the Word. In the hands of the goddesses, however, the papyrus staff represents more particularly the *affection* of truth, the *love* of the Word. (Odhner, p. 16.)

The name of the symbolic feather, as of the goddess, is *maat*, which means "what is straight," a rod, rule, canon, and it came to mean everything that is "right, true, truth; what is real, genuine, upright, righteous, just, steadfast, unalterable." (Wallis Budge, "The Gods of the Egyptians, Vol. I, p. 417.) The reason for the association of the ostrich feather with Maat, the goddess of *truth*, is unknown, as is also the primitive conception which underlies the name, but it is certainly very ancient, and probably dates from predynastic times. (Budge, p. 416.)

To a Newchurchman, however, the reason is not far to seek. The feather is the constituent part of a wing, and wings signify doctrines of spiritual truth, the systematic and orderly arrangement of truths in a series, by means of which the mind

is elevated into higher regions of thought. Such were the wings of Pegasus; such are the "wings" of the angels. [Swedenborg, however, assures us that all angels are in the human form and have no need of wings, though they may sometimes assume such appendages on account of their symbolic meaning.] Thus the "great eagle with great wings and many feathers," in Ezekiel XVII, 7, "signifies the truths of faith, with an abundance of the knowledges of truth and good." (*Arcana*, n. 8764; *Apocalypse Explained*, n. 281.)

The feather became the universal emblem of truth from the fact, also, that from time immemorial the quill has been used as the writer's pen ("pen," from the Latin *penna*, means a feather), and writing—strange to say—was used originally for no other purpose than to communicate *truth*. (Odhner, p. 18.)

One of Mr. Odhner's most notable discoveries relates to the historic crown of the Pharaohs, *as interpreted by correspondences*.

The crown of Lower Egypt (called "tesher") evidently represents a vessel for drawing water, and the curled feather, which is always seen rising out of it, is the general emblem of truth. The combination, therefore, suggests the faculty of the *understanding* containing the *truths* of wisdom, and as a divine crown it would seem to represent the Divine Wisdom whence the Divine Truth is derived. It is always painted a red color, because wisdom is of good. That this is the meaning of the red crown became a certainty when we discovered the signification of the crown of Upper Egypt (called "hetch"), the key to which was furnished by an ancient picture in which it was represented as a sheaf of wheat tied together near the top. Now, wheat is a general representative of *good* and the will of good, and when used in a divine crown it represents the Divine Will, the Divine Love which consists of nothing but the Divine Good. The crown of Upper Egypt is always painted white, to show that Love is of Wisdom. The two crowns taken together, called the "*pschent*" crown, signify therefore the spiritual and the celestial, the understanding and the will, truth and good, faith and charity, and in the supreme sense the Divine Love within the Divine Wisdom.

Applying this key, the mysteries of the whole Mythology of Egypt opened up as if by magic, for the key fitted into every door. Whenever a divinity carries the lower crown he represents some quality of the Divine Spiritual, and whenever he carries the upper crown he represents some quality of the Divine Celestial. This never fails, and it is confirmed by all the scientific facts of Egyptology. (Odhner, pp. 18-19.)

In Amen or Amen-Ra, the great god of Thebes, we have a clear-cut conception, easily distinguished and interpreted. The very first glance at his strong manly figure—always depicted in an attitude of stepping forth, and always wearing the “ureret” crown of two lofty plumes towering from his head-dress—impresses the beholder with the idea of something Divine *standing forth*. Sometimes he is seen with the head of a ram to indicate his close relation to the Infinite itself as represented by Khnemu; sometimes with the head of a hawk, to show his relation to the Divine Proceeding represented by Horus; but always he is wearing the two plumes, in alternate sections colored red, blue, and green; and it is said in the BOOK OF THE DEAD (Chapter XVII, 30) that “the plumes upon the head of Amen-Ra are Isis and Nephthys,” and again, “his two eyes are the two plumes which are upon his head.”

A feather, as we have seen, was the universal Egyptian emblem of Truth, and the two great feathers or plumes of Amen-Ra the two great truths or doctrines of good and truth, of charity and of faith, which proceed from the Divine Wisdom of the Lord. These two, in their three degrees (the colored sections), make the whole of the Word, and in their reception by the angels they constitute the two kingdoms of heaven (Isis and Nephthys). Amen-Ra himself,—whose body is often colored light blue, like the Brahman Vishnu, as if to indicate his exalted and heavenly character,—is a striking representation of the Divine in its first Standing Forth out of the Infinite, the Divine in its first Form and Manifestation, in other words, the Divine Existere, the Divine Spiritual itself. This interpretation is supported not only by his distinctive symbol, the two feathers, but also by the meaning of his name [“what is hidden,” “what is not seen”] and by the fundamental characteristics attributed to him in the inscriptions. (Odhner, pp. 74-75.)

These significations of the *crowns* accord with what is told us by Swedenborg:

That a crown represented Divine good from which is Divine truth, is evident from the crown of kings; for kings represent the Lord as to Divine truth; hence they had a crown on the head and a scepter in the hand; for government from Divine good was represented by a crown and from Divine truth by a scepter. (*Arcana*, n. 9930, p. 3.)

The reason "a crown" signifies wisdom, is that all things which invest and distinguish man derive their signification from that part of man which they invest or distinguish. "A crown," therefore, signifies wisdom, because it is a distinction for the head, by which is signified wisdom, because it resides there. (*Apocalypse Explained*, n. 1263.)

Sir Gardner Wilkinson, in his "Manners and Customs of the Ancient Egyptians," gives a figure (No. 497) of the "tet" or pillar of degrees, which is very interesting and is alone sufficient to overthrow the suggestion that it was meant for a picture of the Nilometer at Elephantine, used to measure the height of the inundation. The picture (Fig. 16) shows a man kneeling upon the earth and upholding the "tet" with his hands; above his head is a small sun. The "tet" itself shows a pair of arms and the usual three degrees, above which a scarab is standing with its forelegs raised in adoration of a higher sun. The meaning of the figure is self-evident to a New-churchman and could well be used as an illustration of the doctrine that the human race beneath the natural sun is the support and basis of Heaven as a Grand Man. The scarab represents human life in ultimates and in inmosts, the whole of which is, or should be, directed solely to the worship of the Lord in His Heavenly Sun. (Odhner, p. 22.)

"We have become convinced," says Mr. Odhner, "that it [the 'tet'] was originally a representation of a palm-tree, but its natural origin is of less interest than its spiritual signification. We believe that it stands in general for (a) the *Tree of Life*, which figures so prominently in all the ancient



No. 497. Ptah
under the form of
Stability.

FIGURE 16.

mythologies, and that in prophetic anticipation it signifies (b) the glorified body of the *Risen Lord*, who Himself is the Tree of Life. It is to be noted that the 'tet' is always and exclusively the symbol of OSIRIS, the God-man." (p. 22.)

In adopting the classification of the principal deities given by Dr. Wallis Budge in his book, "The Gods of the Egyptians," and in substituting the spiritual significatives for the several persons, derived through correspondences, Mr. Odhner obtains a list which reads very much like Swedenborg's enumeration of the principal doctrines of the New Church, a striking confirmation of the undoubted affinity between the two systems of religious doctrine on which we have already remarked.

The Pantheon of Egypt numbers about eight hundred deities, but out of this chaotic multitude there are only about two dozen that stand forth in very distinctive outlines. These group themselves as follows, according to their emblems and attributes, in correspondence with the essential ideas of the Theology of the Ancient Church as understood in Egypt.

MALE DIVINITIES

1. KHNEMU. Symbol, the ram = the Infinite Father, the Divine Esse.
2. AMEN. Symbol, the two long plumes = the Divine Form, the Divine Existere.
3. RA. Symbol, the solar disk = the Divine within the spiritual sun.
4. PTAH. Symbol, the pillar of degrees = the Logos, Divine Revelation.
5. THOTH. Symbol, the Ibis and writing tablet = the written Word.
6. HORUS THE ELDER. Symbol, the hawk = the Divine Proceeding, before the Incarnation.
7. KHENSU. Symbol, the moon = the Divine Truth as the proceeding Divine.
8. OSIRIS. Symbols, the staff and the whip = the glorified Human, the promised Messiah, judging the quick and the dead.
9. HORUS THE YOUNGER. Symbol, the infant lock of hair = the Holy Spirit, proceeding from the Glorified Human.

10. ANUBIS. Symbol, the jackal = resurrection after death.
11. KHEM, the one-armed mummy with a whip = Ham, father of Mizraim and ancestral god of Egypt.
12. ATEN. Symbol, the solar disk with rays ending in hands = the "Adonai" of the Hebrews.
13. BES, a grotesque figure with a harp = the god of mirth.
14. SET. Symbol, the black tapir = the evil power.

FEMALE DIVINITIES

15. ISIS, the wife of Osiris. Symbol, a throne = the Celestial Kingdom and the Internal Church.
16. NEPHTHYS, the associate wife of Osiris. Symbol, a house = the Spiritual Kingdom and the External Church.
17. SATET, the wife of Khnemu. Symbol, the Upper Crown = Celestial Good, identical with Isis.
18. ANGAT, second wife of Khnemu. Symbol, a cap of feathers; identical with Nephthys.
19. NUT, the wife of Amen. Symbol, the vulture = the universal motherhood of Heaven and the Church.
20. MAAT, the wife of Ptah. Symbol, the single feather = spiritual good, the affection of truth in general.
21. HATHOR, the goddess of love and beauty. Symbol, the cow = natural good, conjugal love.
22. BAST. Symbols, the lioness and the basket = the good of charity in general.
23. NEITH. Symbols, the bow and the shuttle = the good of faith in general.
24. TAURT, the wife of Set. Symbol, the female hippopotamus = the love of evil. (Odhner, pp. 69-70.)

Swedenborg declares that it is impossible to understand the states of spirits and angels with their innumerable varieties unless one has a knowledge of the human body. This is because the Lord's kingdom is like a man. In fact he compares a human society, both in this world and the next, to a living human body, in which, of necessity, there must be organization.

The lungs of their respiration act upon the ribs and the diaphragm, and through these by means of ligaments and

through the peritonaeum, upon all the viscera of the body throughout, and likewise upon all its muscles, and not only involve, but also thoroughly enter them, and so thoroughly that there is not the smallest part of the viscera nor of a muscle, from the surface to the inmost, which does not derive something from the ligaments, consequently from the inspiration. This is the case with the stomach more than the rest of the viscera, in consequence of its oesophagus passing the diaphragm adjoining itself to the trachaea which comes from the lungs; hence the heart itself, besides its own, has also a pulmonary motion, for it lies upon the diaphragm, and in the bosom of the lungs, and coheres and is continued with them by its auricles. In like manner, also, what is respiratory passes into the arteries and veins, on which account they have their joint dwelling in one chamber separate from the rest of the body, which chamber is called the breast. From these considerations an attentive eye may see that all living motions, which are called actions, and exist by means of muscles, are effected by the coöperation of the motion of the heart and of the motion of the lungs which is in each, both the general motion which is external, and the particular motion which is internal; and he who is clear-sighted may also discover that these two fountains of the motions of the body correspond to the will and the understanding, since they are produced from them. This has also been confirmed from heaven, where it was given me to be present with the angels, who presented this to the life. They formed a likeness of the heart and a likeness of the lungs, with all the interior and exterior things of their con-texture, by means of a wonderful and inexpressible flowing into circles, and they then followed the flow of heaven; for heaven has a tendency to such forms, by virtue of the influx of love and wisdom from the Lord. Thus they represented all the particulars which are in the heart and all the particulars of the lungs, and likewise their union, which they called the marriage of love and wisdom. And they said that the case is similar in the universal body and in each of its members, organs, and viscera, with the things which are of the heart therein and which are of the lungs therein; and that when they do not both act, and each takes its turn distinctly, there cannot be any motion of life from any voluntary principle, nor any sense of life from any intellectual principle. (*Concerning the Divine Wisdom, vi.*)

With every society and every angel of heaven, in correspondence with these things, the impulses of the heart of heaven continually inspire love from the Lord; and the respirations of the lungs of heaven constantly interpret this love in forms of useful love to the neighbor. For the heart supplies the fluid and the pressure by which every gland and fiber is filled; and from the lungs is continued the sheathing by which the quality of the fluid received is determined, and the alternate motion of expansion and contraction by which reception is effected; and the sheaths of the fibers are continued into the tendons by which all motion is directed. (*Ibid.*, x, 4.)

Again Swedenborg tells us:

It was given me to perceive the general operations of heaven as manifestly as any object is perceived by any of the senses. There were four operations which I then perceived. The first was into the brain at the left temple, and was a general one as to the organs of reason; for the left part of the brain corresponds to things rational or intellectual, but the right to affections or things voluntary. The second general operation which I perceived, was into the respiration of the lungs, which led my respiration gently, but from within, so that I had no need to draw breath, or respire, by any exertion of my will. The respiration itself of heaven was then manifestly perceived by me. It is internal, and on that account imperceptible to man; but by a wonderful correspondence it flows into man's respiration, which is external, or of the body, and if man were deprived of this influx he would instantly fall down dead. The third operation which I perceived, was into the systole and diastole of the heart which had, on the occasion, more of softness with me than I had ever experienced at any other time. The times of the pulse were regular, about three within each turn of respiration; yet such as to terminate in and regulate the lungs and what appertains to them. How the alternate changes of the heart insinuated themselves into the alternate changes of the lungs, at the close of each respiration, I was in some measure able to observe. The alternations of the pulse were so observable that I was able to count them; they were distinct and soft. The fourth general observation was into the kidneys, which also it was given me to perceive, but obscurely. From these things it was made manifest

that heaven, or the Greatest Man, has cardiac pulses, and that it has respirations; and that the cardiac pulses of heaven, of the Greatest Man, have correspondence with the heart, and with its systolic and diastolic motions, and that the respirations of heaven, or the Greatest Man, have correspondence with the lungs and their respirations; but that they both are unobservable to man, being imperceptible because internal. (*Heavenly Arcana*, n. 3864.)

The following verse, transcribed from the Ancient Word, which was in Egypt and therefore available to Moses, tells of the respiration of an anterior Church having open intercourse with heaven,—the Most Ancient Church:

“Verse 7. *And Jehovah God formed man, dust from the ground, and breathed into his nostrils the breath of lives; and man became a living soul.* To form man dust from the ground, is to form his external man, which before was not man; for it is said in the fifth verse that there was no man to till the ground. To breathe into his nostrils the breath of lives is to give him the life of faith and of love. ‘Man became a living soul’ means that the external man also became living. The subject here is the life of the external man—in the two preceding verses the life of his faith, or understanding, in this verse the life of his love, or will. Before, the external man was not willing to obey and serve the internal, but continually fought against it; wherefore the external man was not then man. But now when he has become celestial the external begins to yield obedience to and serve the internal, and becomes also man—and this through a life of faith, and a life of love. A life of faith prepares him, and a life of love makes him to be a man. As to the saying that Jehovah God breathed through the nostrils, the case is this: In ancient times, and in the Word, by the nostrils was understood whatever was grateful for its odor which signifies perception. We therefore read occasionally concerning Jehovah that He

'smelled an odor of rest' from burnt offerings, and from things that represented Himself and His kingdom. And because things which are of faith and love are most grateful to Him, it is said that He breathed through the nostrils the breath of lives. Hence the Anointed of Jehovah, or the Lord, is called the breath of the nostrils. (Lam. iv, 20.) And the Lord Himself signified the same by breathing on the disciples—in John: *He breathed on them and said*, Receive ye the Holy Spirit (xx, 22.) Life is described by breathing and by breath for the further reason that the men of the Most Ancient Church perceived the states of love and faith by the states of respiration, which states were gradually changed in their posterity." (*Heavenly Arcana*, n. 94 to 97.)

Introduced by these passages from one who has labored in his own way but with the Lord's guidance to restore the lost wisdom of Egypt, I invite your attention to Dr. Wilkinson's interpretation of the great Egyptian classic, which was considered so sacred and so potent that a copy of it was interred with nearly every Egyptian mummy,

covered with writing upon Suten,
both inside and outside,
placed underneath his left arm,
evenly with his heart.

THE BOOK OF RESPIRATIONS

1. Commencement of the Book of Respirations made by Isis for her brother Osiris, to give life to his soul, to give life to his body, to rejuvenate all his members anew; that he may reach the horizon with his father, the Sun; that his soul may rise to Heaven in the disk of the Moon; that his body may shine in the stars of Orion on the bosom of NUT; in order that this may also happen to the OSIRIS, divine Father, prophet of AMMON-RA, king of the gods,

Prophet of KHEM, of AMMON-RA, bull of his mother, in his
great abode.

ASAR-AAU, justified,

Son of the Prophet of the same order, NES-PAUT-TA-TI, justified.

Conceal (it), conceal (it)!

Let it not be read by any one.

It is profitable to the person who is in the divine Nether-world. He liveth in reality millions of times anew.

(Translated by P. J. De Horrack. First of 14 sections.)

DR. WILKINSON'S COMMENTS

The Book of Respirations, otherwise the Book of Breath, in its internal sense, as interpreted to Egypt by correspondences, is an assumption of divine quality for union, by an imperfect nature about to be raised up to heavenly properties. Sister Isis, by love, works for this union, herself making the Book of Respirations for her brother Osiris. Some death has overtaken him; he is in some place where he has lost his true life, and by the power of the instruction of respirations he is to be lifted from it. He is to rise by his breathing a new man, newly animated in soul, body, and members. The union is to be with his Father, the Sun, the spiritual sun. He communes with the reflex sciences which are the moon in its mirror of truth; and his Knowledge is of the stars of Orion's belt from which he shines down into his powers from the upper firmament of heaven. Active Breath, Spirit, is here the medium.

His father, now also Osiris, for we are speaking of God-Man, separable into many names or qualities, as into father, son, husband, justifies the divine assumptions which will become his properties and attributes. They are holy things; mysteries as yet hidden from the Egyptian Church under the veil of Isis. They belong to him of right who is in the divine Nether World, and who lives in reality millions of times anew. A divine man here in power in the Divine Nether-World is plainly signified.

Isis as sister of Osiris is the first Egyptian branch of the genius of the Ancient Church. The respiration made for that Church is the spirit of natural and curious cautious order imparted and suggested in the remains of traditional correspondences. They contain divine truths which now are Osiris. In this inauguration he signifies a great One to come towards whom He travels, and who resides in the divine sun. It is a process, from night to day,

under the discipline of father Osiris. Science also is reduplicated in the moon-breath, and elevated knowledges of goodness and truth by gift of place on the upper firmament of natural body and organism, are created and received. The breast of the upper hemisphere of heaven is the shining light of Orion. Compare Revelation XII, 1, "A woman clothed with the sun, and the moon under her feet, and upon her head a crown of twelve stars."

Is this interpretation permissible? It is demonstrated by results. We are not dealing with an artificial mythology the work of mankind, but with a Church which had many branches, and which passed through the stages of infancy, youth, manhood into old age, declining at last into idolatry, and undergoing consummation and judgment. At first, as revealed in the Word, the dispensation was a divine gift, a Church.

A point arises which requires consideration. We have in Egyptian Annals many names of Gods all of which are credited by the learned as heathen deities. We also know from the Word of the Old Testament that Egypt in its first periods entered an Eon where it shone with memorable light; where attentive knowledge of fact from without was born, and applied to original authoritative churches; where priesthood in a sense of ultimatum and dead immortality was monumental shadowing eternal. Where demand for visibility heralded the day of God Visible. One fact is that we have names of Egyptian gods recorded in the Pentateuch, and yet the annals of the Egyptian churches are admitted to be genealogies numbered by thousands of years. Now are not some of the names Egyptian designations of the one true and perpetually Advent-God? Otherwise we have no declared deity in the records of Egypt, but only mythological idols. To put the matter home, are not Osiris and Isis divine for Egypt as Elohim, Jehovah, Jah, and God Schaddai are divine names for Israel? (Wilkinson, pp. 9-11.)

We have seen that Mr. Adams has supplied the facts which give an affirmative answer to this question.

It is also alleged by Egyptologists before Champollion that Egyptian Astronomers knew that the Earth went round the sun but held also, as the Bible does, that the Sun in another, and Osirian sense, in a spiritual and internal use and usage, went embracingly day and night round the Earth, the *Church*, a

guardian God. The Psalms would not repudiate such correspondences.

The fourth section of the Book of Breath reads thus:

“Hail to the *Osiris N!*” [Here is inserted the name of the deceased, identified for the time being with Osiris, as receiving his benefits and sharing his life. “Because I live, ye shall live also,” said Jesus.]

Thine individuality is permanent.

Thy body is durable.

Thy mummy doth germinate.

Thou art not repulsed from heaven (neither from) earth.

Thy face is illumined near the Sun.

Thy soul liveth near to AMMON.

Thy body is rejuvenated near to OSIRIS.

Thou dost breathe for ever and ever.

The Christian Church came to its end in 1757. What are the churches of today but mummies? Relics of a dead past, they still endure. But, though the winter has been long, the fig tree begins to put forth new leaves. Something from the Spirit of its Founder will not let the body wholly die. Its mummy doth germinate!

Thy mummy is thy tree of immortality. Thy soul liveth near to Ammon-Ra, the living Sun, to accept this increase of scientific respiration of new consciousness. The creation and constitution of the divine-natural man, OSIRIS N the son of Osiris, is now pursued into realities which were the name the OSIRIS N wore. Name signifies quality, and divine Fact in Act was the Son's ultimate degree. He passed through Egypt in her Church Eon, and after his natural birth, was taken with Joseph and Mary down into Egypt. The mark of testimonial knowledge was written upon his childhood. Its persistence and fixity are now recorded of him. Osiris, the Father, by divine influx, hails him and makes Him Lord of the powers of truth. He is not effaced by the Father but confirmed in Godhead as a new glory of Osiris. He is taking possession of the natural universe as a human estate, and whereas death has voided all its other tenants,

he, once slain, rises from his tomb and outlives time and posterities. "Thine individuality is permanent; thy body is durable; thy mummy doth germinate or grow." Tradition from Him in the Church, although it be dead, is ineffaceable, and is the seed of natural churches, here called mummies. He has his own divine ground in heaven and on earth. He enjoys intercourse as Man with Man in express rays of the spiritual sun. The body of his youth is born anew in the love and nearness of His OSIRIS. The love and nearness of Ammon comes first. The nearness to Ammon is predicated of the Soul. Swedenborg's interpretation of Ammon, who here comes before Osiris, presents the genealogy in connection with Moab, and yet as having some simple reality which belongs to the Noahitic Church. The drama of Egypt extends backwards into times before corruption had laid its hand upon the religion of the priesthood; or Ammon of Thebes, now recurring to Egyptology, may have uses connected with the OSIRIS N which we do not divine. We note that the treatment of Egypt in the Word of God makes that realm a part of correspondential human history, and that few names of deities are given. This leaves the question open,—whether Egypt had not its own true Gods in its given beginning. The context of the Book of Respiration touches so closely upon Christianity as it was received in its Churches, and some characters are so manifestly divine, and near to the coming Religions of the Word, that we are justified in ranking them, though hitherto regarded as heathen deities, as among divine presences of the Noahitic Egyptian dispensation. Especially may this be said of Ammon-Ra, for He is a God encompassed by the Spritual Sun, and in that glory must be regarded as a principal attribute of Deity in that Eon. (Wilkinson, pp. 17-18.)

This conclusion seems to be fully confirmed by Odhner's examination.

Still upon organic science, correspondential in Egypt, and to become celestial in the New Jerusalem, we pause to consider the revelation, that the angels "following the flux of heaven," have creative power to direct the several structures of the human form, which become recipient of life from their wills and minds. At the same juncture of states they foresee and breathe into being their own perceptions, images, and likenesses full of the

truths and functions of love and wisdom. Descent from the Lord by His Spiritual Sun is the creator of the angelic heaven; and here, again, for science's sake, as first teaching to mankind, the human body in any of its least parts can be represented by charts of progressive respirations; and every word, syllable, and iota of living construction can deliver the divine letter of its use and command.

Swedenborg gives many examples of such co-angelic creations. Among them as the great end of the DIVINE LOVE the initiation of man as it is by conception was discovered to him by the angels, to whom it was revealed by the Lord. "They, because they had made it a subject of their wisdom—and it is the joy of their wisdom to communicate to others what they know—by permission presented the initial form of man in a type before my eyes in the light of heaven! The light of heaven creates illuminated facts from above; for its entire universe in its illimitable Kingdoms stands as reality out of that light born from its loving, living heart. . . . Love is the gate through which creation and revealment come. Intuition and perception, spiritual mothers of science, are sacred gifts of universal organic wisdom."

"Create in me a clean heart, O God, and renew a right breath within me. Cast me not away from thy presence, and take not Thy holy Breath from me."

"Restore unto me the joy of Thy Salvation; and uphold me with a free breath." (Wilkinson, pp. 98-99.)

CHAPTER XV

SWEDENBORG AS AN ANATOMIST

IN July, 1736, after fruitful years spent in astronomy, physics, engineering, metallurgy, and kindred sciences of the inorganic world, Swedenborg turned his attention to the human body; and went to Paris to study anatomy. In 1738, on March 12, he left Paris for Italy, to continue the same studies, remaining there until May, 1739, when he returned to Paris, where he finished his *Economia Regnis Animalis* whose title discloses the end he had in view in these labors. It was the investigation of the body as the kingdom of the *soul*.

For several centuries the Popes of Rome, to their credit, be it said, at a time when most people, including the civil authorities, had a violent prejudice against the dissection of the human body, had lent their influence to protect the anatomists from undeserved persecution and to facilitate their labors in behalf of humanity. Consequently, a basis of anatomical fact, so necessary for the elucidation of psychology, was already in existence at this time. Such knowledge was most necessary in order that the spiritual world, which was about to be unfolded to more intimate apprehension, might be understood, or perhaps even experienced. Swedenborg's work was not so much to complete the body of known anatomical fact, as to explain the meaning of much that was obscure. Here he did his work so well that although his great work on "The Brain" was permitted to remain unpublished for 140 years, its very existence unknown save to a few, yet when the manuscript was transcribed and translated by Dr. Tafel, it was found that it had not been superseded but even that it could hardly have been appreciated earlier.

The following enumeration of some of the discoveries contained in Swedenborg's work on "The Brain" is excerpted from Dr. Tafel's preface to his edition of that work:

1. The coincidence of the motion of the brain with the respiration was first publicly set forth in his "Economia," etc., Vol. II, published in Amsterdam, in 1741, . . . The discovery of this fact is now universally attributed to J. Daniel Schlichting, a physician of Amsterdam, whose observations on the motion of the brain were published in 1750. . . . "We have referred to the works of upwards of a hundred authors," says Dr. Tafel "and with the aid of the modern school of physiologists representing the 'Graphic Method' introduced by Professor Marey in Paris, we believe that every one of the positions laid down by Swedenborg in reference to the motion of the brain is now definitely and satisfactorily established."

2. The extension of the respiratory motion of the brain and lungs to the extremities of the body, which Swedenborg distinctly announces in his "Regnum Animale," Vol. II, published at The Hague in 1744, pp. 116-121. The discovery of the respiratory motion in the extremities is attributed to Dr. Piégu, who published in 1846 a "Note on the Double Movements observed in the limbs," etc.

3. Dr. Piégu imagined that the motion of the lungs produces that of the brain; but Swedenborg reverses the order. He says: "The lungs, and the brains with the medulla oblongata and spinalis, are synchronous in their respective animations and spirations; and this, that causes may act harmonically, and conspire in operation with effects; things prior with things posterior; and the spirit of the soul with the spirit of the body; and in order that there may be an influx and reflux of one into the other. On these accounts, the pulmonic engines or bellows rise precisely at the same moments that the cerebrum inspires its costal, and the cerebellum its sympathetic nerves. . . . The complete concordance is perfectly manifest from all actions. Thus when the mind is thinking very intently, and breathing tacitly and slowly, then the lungs, elevated to a certain degree, appear in like manner to keep silence, and to send out and draw in the air almost imperceptibly, so as not to disturb the analysis of the rational mind by any motion on their part. On the other

hand, when the mind is heated with passion, and the cerebrum acts tumultuously, and as it were swells and surges, then the lungs likewise boil up." (*Regnum Animale*, Vol. II, n. 398.)

4. The reality and existence of the cerebro-spinal fluid, which Swedenborg discovered as early as 1736 or 1737. . . . The discovery of this liquid is ascribed to Cotugno, whose treatise entitled "*De ischiade nervosa commentarius*," was published in Naples in 1764.

5. The circulation of the cerebro-spinal liquid through the interstices between the fibers of the nerves of the body, which Swedenborg describes most minutely. . . . This fact, which has not yet (1882) been adopted by the compilers of our text-books in anatomy and physiology, is confirmed in all its particulars by Key and Retzius in their "*Studien*," etc.

6. According to Swedenborg, the fibers of the cerebrum tend towards the anterior parts of the spinal cord, but the fibers of the cerebellum, *i. e.*, of its third or restiform process, seek the posterior parts. (Recently confirmed by Meynert in Stricker's "*Manual*.")

7. Swedenborg teaches plainly that the fibers of the cerebrum and cerebellum run through the longitudinal dimension of the spinal cord, while those fibers which the spinal cord generates from its own grey substance intersect the former transversely and obliquely. . . . Solly says that "*Bullingeri* was the first who in 1823 demonstrated the double origin of the spinal nerves from the grey as well as the white matter of the cord; that this fact, however, was not established, or generally believed in England, till 1837, when Mr. Grainger published his treatise entitled, '*Observations on the Structure and Functions of the Spinal Cord*,' in which he distinctly enunciates this important truth."

8. The anterior province of the cerebrum, according to Swedenborg, is the seat of the intellect, thence also the voluntary efforts proceed. "If this portion of the cerebrum is wounded," says he, "then the internal senses—imagination, memory, thought—suffer; the very will is weakened, and the power of determination is blunted. This is not the case if the injury is in the back part of the cerebrum." . . . Dr. Althaus in summing up the results obtained by Fritsche and Hitzig in 1870, and Ferrier a short time afterwards, says, "The anterior or frontal lobes, cor-

responding to the forehead, are the actual seat of the intellect. . . . Patients have now and then recovered from the most fearful injuries to the anterior lobes; . . . but it has always been shown in close examination that there had been a profound change in the character and behavior of such persons, and that their temper and their moral faculties had become deteriorated." *Nineteenth Century*, 1879, p. 1031.)

9. Swedenborg's division of the brain into lobes differs from that in use at the present day. His division is that which is presented by the median aspect of the hemispheres. His highest lobe is bound by the marginal convolution and the quadrate lobule; his middle lobe by the lower part of the marginal convolution and gyrus fornicatus; and his third lobe is identical with the temporosphenoidal lobe. On the basis of this division he says, "The muscles and actions which are in the ultimate parts of the body, and thus in the soles of the feet, depend more immediately upon the highest portions of the cerebrum; upon the middle lobe the muscles belonging to the abdomen and thorax; and upon the third lobe those which belong to the face and head; for they seem to correspond to one another in an inverse ratio: . . ." (Confirmed by Ferrier's experiments on the electrization of the brains of living animals. "Ferrier's Functions of the Brain," pp. 141-157.)

10. Swedenborg says, "The corpora striata are vicarious cerebra, and they succeed in the place of the cerebrum, whenever it is deprived of its power of acting," etc. . . . This is exactly what Ferrier and his school have established by experimenting on the corpora striata.

11. Swedenborg established the connection of the corpora quadrigemina with the sense of sight. He says, "These fibers (*i.e.*, those of the corpora quadrigemina) tend upwards into the surface of the optic thalami, and at the same time penetrate more deeply into them; and thence in conjunction with the fibers of the cerebrum they direct their way towards the bulb, the coatings, the humors, the iris, and the pupil of the eye, that is, chiefly towards those parts of the eye which are being adjusted to the objects at the time, and indeed spontaneously." . . . Ferrier says "Flourens (in 1842) first experimentally demonstrated that the optic lobes (*i.e.*, corpora quadrigemina) were the centers of

co-ordination between retinal impressions and movements of the iris." (Functions of the Brain, p. 71.) And again he says, "The facts of anatomy and those of physiological experiment mutually support the view that the corpora quadrigemina, though not the centers of conscious vision, are centers of co-ordination of retinal impressions with special motor reactions." (*Ibid.*)

12. Concerning the corpus callosum Swedenborg says that "its fiber is concentrated in the body of the fornix" . . . "Thence," he further says, "these fibers are not allowed forth any further, nor do they return to their origins, but they stop there and are consumed there." A similar view to this has been adopted fifty years later by Gall, Reil, Burdach, Arnold, Herbert Maye, Solly, Hirschfeld, and others.

13. The next item I will transcribe somewhat more fully from the body of the work, as an example of Swedenborg's striking style.

Blood enters into the choroid plexuses from the body, and (animal) spirit from the brain. The blood is conveyed to them by the common branch of the carotid and vertebral arteries, and spirit through fibers from the fornix, and thus from the opposite direction, and each from its extremity; for the blood flows into the plexus in the descending cornu, and the spirit from the other side, namely, from the fornix. There are, indeed, thin, very soft and moist fimbriae and roots which extend from the body of the fornix and are affixed to the highest coasts of the plexuses; these pour out the pure spirit, which by numerous fibers of the corpus callosum is conveyed to its center of rest, the body of the fornix, which on this account is called the fimbriated appendage of the corpus callosum. The blood is conveyed to meet this spirit; and by coursing through the web of the plexus, it is consociated and mixed with the arriving spirit in every point, and in this way celebrates as it were a marriage union with its spouse. The whole fabric of the plexus is glandular in appearance; the blood circulates in it, as through anfractuous little gyres; and it instils its serum into every least cavity, into every least place, where the fiber also instils its spirit; thence is conceived and born that moisture which the succeeding organs separate, filter, and rectify. The cool temperature of the ventricles favors this marriage union; for if the naked spirit, not confined somewhat within a

efined serum, were poured into the cavities of the ventricles, on account of its great volatility it would exhale through the rafters of the sides and the roofs without determination, and would thus be dissipated. This is the first composition of the fluid, and it is accomplished in the plexuses by the alternate expansile and contractile motion of the whole, and the synchronous motion of the individual parts.

The newly-born moisture which by its impregnation with a copious supply of spirit has been made liquid, is discharged from its follicles abroad through an equally great number of little missary ducts and arteries which are situated in the membrane of the meninx which encompasses the plexus. Thus by little mouths it is distilled thence into the cavities of the ventricles, at either side of the thalami optici. Thence by a swift and declivitous course it is conveyed at the very time when the ventricles contract themselves, towards the two anterior and posterior foramina, which are called "vulva" and "anus." (Swedenborg: "The Brain," translated by R. L. Tafel, I, n. 511, n. 512.)

Science generally regards the texture of the choroid plexuses as a continuation of the velum interpositum; but Key and Retzius by their investigations have shown that the choroid plexuses in the lateral ventricles consist of two leaves of which the upper leaf is derived entirely from the fimbria of the fornix and the lower leaf partly.

14. Swedenborg says. "In order that the brain may have the faculty of performing its functions, it must be constantly purged and relieved from that liquid which is perpetually expressed from its members and arterial vessels. . . . There are a number of foramina by which the lamina cribrosa of the ethmoid bone is pierced in many places. Not only fibers, but also the pia, and at the same time the dura mater, pass through these foramina; the pia mater investing the fibers, and the dura mater lining the orifice. . . . The above liquid (between these membranes) passes the cavities of the nose through these openings." The discharge takes place during the expansion of the cerebrum, when, according to Swedenborg's theory, the nerves are extended and elongated, thus granting passage to a liquid through the foramina of the lamina cribrosa. "In defunct brains, however," he declares, "and in such as are collapsed, these com-

municatory passages must needs be closed." . . . The truth of this doctrine, which is diametrically opposed to that set forth in our text-books, has recently been confirmed by experiments which Key and Retzius made on the bodies of rabbits that had just been killed.

15. In relation to the cortical substance of the brain Swedenborg says, "The brain is made up of as many similar forms and natures as it has discrete cortical parts." (*Economia*, etc., Part II, n. 304.) "External sensations reach no goal beyond the cortical spherules, since these are the beginnings of the nerves and medullary fibers. . . . Therefore it is the cortical substance collectively that constitutes the internal organism, corresponding to the external organism of the five senses." (*Ibid.*, n. 191.) "The cortical substance is the unit of the whole brain; in this unit or substance, then, we ought to find that superior power of which we are in quest. Therefore in this, and not in any ulterior unit, because the cortical substance is the ultimate unit of the brain, we ought to find the soul's faculty of understanding, thinking, judging, willing." (*Ibid.*, n. 304.) Swedenborg wrote and published this in 1741, and yet how very much like a sentiment of Dr. Althaus published in 1879: "The highest in the hemispheres, convolutions, or *grey* (cortical) *surface of the brain*, which is the material base of all mental and moral activity. This portion of the brain, which may be called the seat of the soul, is not a single organ, as was formerly supposed, but consists of a number of thoroughly differentiated organs, each of which possesses certain functions, yet is in the closest possible connection with all the others."

16. As to the origin of the cortical glands Swedenborg says, "The cortical substance is so connected with the minute vessels of the brain that you would believe that the cortical glands derive their origin from these vessels. . . . The above-mentioned glands do not spring forth immediately from the little arteries; but while the arterial vessel continues its course, it produces from its coating such an offspring, and nevertheless pursues its course beyond as an artery." (*Economia*, etc., Part II, n. 329.) In offering this as his conclusion he says, "We own we are not able to add here ocular experience in the way of confirmation; for who is able to reach with the microscope the ramifications of

the arteries themselves, and the stamina or threads which burst at the coatings of the arteries? . . . Meanwhile, using analogy and comparison for principles, we deduce thence a series of consequences; and if these are fully borne out by the individual proofs of experience, we must come forth crowned with certainty to the truth of our principles. . . . This, then, is the consequence or conclusion:

"The cortical glands hang down and sprout forth from the sides and coatings of the producing and generating arteries, scarcely otherwise than as grapes and berries are wont to hang down and sprout forth around the tendrils and shoots of a tree and do not spring forth and produce their fruits from the woody and arrowy part, but from its inner and outer bark." (Ibid.) The confirmation of this conclusion was furnished by Bevan Lewis in a paper published in the Proceedings of the Royal Society, Vol. XVI, London, 1877.

17. From the point of view of his rational induction Swedenborg declared that at the base of the fourth ventricle in the calamus scriptorius there must be one or several foramina through which the cerebro-spinal liquid is discharged from the ventricle. He says, "Upon examining the connection of this ventricle with the double lamina of the pia mater—the tela choroidea inferior—it appears that this lymph is expressed or excreted between the duplicatures of that membrane, . . . which appears remarkably dense around the terminus of the calamus scriptorius. . . . It is thus discharged into the duplicatures between the pia mater and the arachnoidea, and thence through the continuous ducts and follicles of the arachnoidea it is derived especially into the posterior part of the medulla oblongata, where that membrane floats about quite densely and loosely." (The Rain, Part I, n. 714, in Vol. 2, p. 382 to 383.) A distinct foramen in the tela choroidea inferior has since been discovered by Magendie, which has been called after its discoverer, the foramen Magendii. Concerning this foramen Marc Sée says that "its dimensions are very variable, and that it seems to be but one of the lacunæ which are left between the connective fascicles of the lamina, i. e., the tela choroidea." (Revue mensuelle de médecine et Chirurgie, III, 1879, p. 300.)

18. In addition to the place pointed out by Swedenborg, where

since his time the foramen Magendii has been discovered, hints also at the existence of a channel from the fourth ventricle immediately into the spinal cord. He says, "Whether there are still other channels, for the discharge of the lymph; namely whether such a channel is opened immediately from the calamus scriptorius into the medullary portion of the spinal cord, to my knowledge has not yet been discovered. For this purpose the fourth ventricle is contracted into the narrower form of a goose-quill (calamus scriptorius)." The Brain, *loc. cit.*, p. 383. The supposed channel has since been discovered, and is described in the most recent text-books of anatomy under the name of "the central canal" of the spinal cord.

In summing up these discoveries, Dr. Tafel says:

The cases here submitted to the careful attention of the reader include some of the most remarkable instances in which Swedenborg anticipated the discoveries of later anatomists and physiologists. We have collected them with a view of proving thereby the excellency of the method which he employed, and by which he was enabled from an apparently meager supply of facts to deduce true scientific principles. Without those rational doctrines to which we have alluded above, he would not have been able to deduce a theory of the brain so perfect, that during an advance of one hundred and forty years science has not been able to go beyond a single position which he then and there laid down.

Swedenborg attached special importance to the lymphatic system. He says:

The lymphatic vessels of the body are not continuous ducts like the arteries and fibers, but are interrupted, and are of a vesicular and cellular structure, though pervious from cell to cell with an open passage,—which perhaps is demanded by the nature of the fluid, exactly as is the case in the arachnoid tunica which is not continuous but is attached to the meninx by intermediate septa, and is discreted into numerous cells with a passage opening from cell to cell. (The Fiber, translated by Alfred Acton, n. 358.)

The lymphatic vessels convey almost all their juice, collected from every viscus, muscle, gland, into a single thoracic duct; but the arachnoid duct is, from the very first, a single duct diffuse

throughout the whole encephalon. For the viscera and muscles of the body do not cohere, nor do they concord in the forces and moments of their action: and, therefore, the lymph must be conducted into one stream. The case is different in the brains and their medullas. (*Ibid.*, n. 360.)

The thought of the space between the arachnoid and the pia mater as constituting one common lymphatic duct is peculiar to Swedenborg. It connotes the fact that the brain is the chief lymphatic gland of the body. Various considerations favor this view, and also that there is a continual resolution and recomposition of the blood in which the brain plays a chief part, though the idea that the globule of the red blood is resolved into lesser components appears to have been a mistake founded on imperfect observations by Leeuwenhoek.

The lymphatic vessels of the body unload their pure lymph into the subclavian; to the end that their juices may return by a circle from blood to blood, and may enter the red blood which is resolved at every turn of the circulation. It is a little different in the case of the arachnoid duct which, in fact, unloads its juice not immediately, but mediately, after it has first passed through the structure of the nerves. (*Ibid.*, n. 361.)

This last, however, can hardly be admitted. While some of the fibers in the brain are tubular, the nerves in their final state do not act as conductors of fluid flow; for if nerve-impulses depended on the flow of a fluid, their actual speed would be impossible. The friction in tubes of such minute bore would be enormous, and while capillary attraction would aid the passage, it could produce no flow in tubes already full. Actually the nerves appear to be composed of a gelatinous solid. Fibers of more than one sort are plainly indicated.

As to the use which the brain performs for the blood, the following is Swedenborg's theory:

The medullary and white substance of the cerebrum is seen to exist and find its origin in the confines and termini of its cortical substance. Hence the medulla is a congeries of mutually inter-

woven fibers and little vessels which connect with each other various ways, though for the most part after the manner of network, and thus at intervals; and it comes forth as a globe almost egg-shaped, or as a great medullary nucleus, called by the old anatomists the Corpus Callosum, and by the moderns Centrum Ovale. This globe is not a continuous globe, but is wonderfully cut up into members and cavities, such as eminences, tubercles, fornices, glands, ventricles, aqueducts, fissures; which when deeply examined and weighed in the order in which they succeed each other and co-operate, indicate with some clearness that the cerebrum is a large gland, and a laboratory completely furnished with chemical organs, or vessels. . . . For the vitæ juice, or animal spirit, is conceived and brought forth in the cortical substances, which are so many most perfect chemical laboratories, or most simple of nature's glands. Following the medullary threads through the corpus callosum, and thence across the base of the fornix and along its ventricles near the choroid plexuses; and commingled with the lymph distilled in these plexuses, and by the ministration of glandular tubercles, it is let down through two foramina into the third ventricle; and so through the infundibulum and the filter of its beak into the pituitary gland, and from this by the little sinuses and receptacles of the sella Turcica into the jugular vein. To the end that the blood, returning from the brain dry, and languid, and soon to be ingenerated with new chyle, and to go down into the right chamber of the heart, may be vivified with spirit. Hence also derived the life of the blood whence is the life of the whole body. (The Fiber, n. 74a.)

Swedenborg distinguishes several kinds of brain fiber and says:

From these considerations it is apparent that the fiber of which the medullary body of the cerebrum is fabricated is principally devoted to three offices, namely, that it may conduct spirit and life to the blood; that it may transfer external sensations to the common sensory; and lastly, that it may excite voluntary acts. (*Ibid.*)

This conception, that the blood is vivified by certain substances secreted by the brain, is borne out by the modern dis-

covery of the peculiar efficacy of even minute quantities of certain glandular secretions (the *vitamines*) some of which are found to be essential to life.

When the heart is being formed in the embryo chick, the spiritual principle, or soul, which is life itself, first produces a current in that portion of the fluid contents of the egg which will become that organ; and the fluid gradually assumes a more rigid consistency, at the same time being guided into a motion conformable to that which it must eventually follow and of a shape suitable to the mechanism of a pumping organ, which, however the result is secured, implies a knowledge of the principles of machinery and a pattern, in other words, a designer who never makes a mistake in adapting means to end.

As to the origin of various sorts of fibers the following may be quoted from Swedenborg:

Motor, fleshy, muscular, tendinous, brawny, and even cartilaginous and osseous fibers, must be derived from fibers, vessels and ducts. All things are soft in their origin, even those matters which in time grow hard and bony; for the hard arises from the soft; from that which is continuous and coherent, from that which is contiguous and fluid. For unless beginnings were fluid and thus enjoyed free power of action, their continuations could never be disposed to the will of fluids. What is compounded must be compounded of parts, and if of parts, these parts must be prior to their compound. Thus the properties that are within the concrete or the continuous aggregate, are to be ascribed to the fluidity of the parts and to their power and nature of acting freely. This is confirmed by the mere anatomy of the embryo in the womb, and the chick in the egg, and, also, by the experience of the eye itself, which shows that motor or flesh fibers consist of coalesced vessels, fibers, and ducts, that tendinous fibers arise from flesh fibers, cartilaginous and osseous fibers from cartilaginous,—and this by the mere force of inertia or by the privation of active forces, that is, of vital motions. (The Fiber, n. 124.)

Confirmation of a general sort may be derived from modern

observation as (e.g.): "Soon after its formation the heart begins to beat, its at first slow and rare pulsations beginning at the venous and passing on to the arterial end. It is of some interest to note that its functional activity commences long before the cells of which it is composed show any distinct differentiation into muscular or nervous elements. To provide contractions of the heart, a system of tubes has made its appearance in the mesoblast both of the embryo itself and of the vascular and pellucid areas." (Elements of Embryology, Foster and Balfour, p. 66.)

From Henri Fabre's "The Life of the Fly" (English Edition, p. 51) I take the following account of the almost completely fluid condition which intervenes between the active, gross-feeding, larval stage, and the transformation into a more highly organized winged creature with wholly different food and habits in the perfect insect:

We must pull down before we can rebuild; the analysis of death is the first step towards the synthesis of life. The substance of the grub that is to be transformed into a bee begins, therefore, by disintegrating and dissolving into a fluid broth. The materials of the future insect are obtained by a general recasting. Even as the founder puts his old bronzes into the melting-pot in order afterwards to cast them in a mould whence the metal will issue in a different shape, so life liquefies the grub, a mere digesting-machine, now thrown aside, and out of its running matter produces the perfect insect, Bee, Butterfly or Beetle, the final manifestation of the living creature. Let us open a *Chalicodoma*-grub (a species of mason-wasp) under the microscope, during the period of torpor. Its contents consist almost entirely of a liquid broth, in which swim numberless oily globules and a fine dust of uric acid, a sort of offthrow of the oxidized tissues. A flowing thing, shapeless and nameless, is all that the animal is, if we add abundant ramified air-ducts, some nervous filaments and, under the skin, a thin layer of muscular fibers.

In the caterpillar of a butterfly, the only thing which fore-

tells future flight is a minute knot of air tubes, completely buried in body tissue, which in due time will expand into the framework of veins supporting the broad wing-membrane which, in turn, is clothed with thousands of sculptured and brilliantly tinted scales arranged in a perfectly definite color-pattern—nothing haphazard about the thing, but each microscopic least detail provided for beforehand and to be known in advance—and yet all of these wonders developing out of what Fabre calls a “fluid broth.” It would be incomprehensible if there were not a spiritual form in which is life and which guides the flowing material.

The initial, or formative substance of the brain, and therefore of the entire body, is what Swedenborg calls the “simple fiber.”

The simple fiber, even from its first origin in the cortical gland which it has woven, sinuously flashes like a ray, toward the ultimate points of the body; and by a wonderful circumvolution or form, which I have called the vortical, it raises up a little canal which is the medullary or middle fiber. Thus this latter is a mere membrane formed by the circumgyrations of the simple fiber. This medullary fiber derives its form of fluxion, which is simply spiral from the vortical fluxion of its simple fiber—according to the law of order in the derivation of forms. (The Fiber, n. 300.)

The medullary or nerve fiber, by a similar mode of circumgyration raises up and conglomerates delicate canals which are least blood vessels, or arterial and venous capillaries; thus these vessels also are mere membranes formed by the winding of the medullary fiber. . . . These vessels derive their form which is simply circular, from the spiral fluxion of the medullary fiber,—according to the law of order in the derivation of forms. (*Ibid.*, n. 301.)

From these fibers, that is, from the simple and compound fiber and the blood vessel, is produced everything which exists in the universal body. (*Ibid.*, n. 302.)

We are also told “that the universal simple fiber is raised

up from forms of a celestial and spiritual nature," and that "the simple fiber, consisting of forms most pure, most active, and at the same time living, cannot but be in perpetual fluxion, that is to say, be determined by the fluxion of its substances." (*Ibid.*, n. 294.)

I presume that this "form of a celestial nature," which is also living, must come from that intermediate or psychical source which is considered in Chapter 7 of Vol. 1. Though not easily comprehended by us, the necessity for such an intermediate appears to be forced upon us. The weaving of the cortical brain-cell is according to a vortical pattern, with which the super-spatial forms of the spiritual world may be most intimately associated. A glimpse of this intricate spirally woven fibrous structure in the cortical cell, enclosing a central lumen and confirming Swedenborg's statement that the cortical cell is a miniature brain with the analogue of a central ventricle, has been obtained by Dr. J. Luys with a microscope of high power, and using special methods. Swedenborg thought that the brain must contain such a structure because there is sometimes a certain sensitiveness to magnetic forces. This is doubtless the way in which the human brain is able to act as a radio receiver and register signals by "wireless," as has recently been discovered.

Swedenborg assigns very important offices to the central nuclei of the brain which are the beginnings of the crura of the medulla oblongata. He says:

The corpora striata are placed over the sense of smell, but the optic thalami over that of sight, wherefore they are also called "thalami nervorum opticorum"; and both together minister to the senses of hearing, taste, and touch. For the roots of the olfactory nerves or bulbs are inosculated in the medullary tracts around the corpora striata. The visual or optic nerves are immediately continued into the optic thalami; but the nerves of hearing and taste are inrooted in the medulla oblongata, and

those of touch in the spinal marrow. These two striated beginnings receive the modes of sensation running towards them, and after receiving them, they despatch them towards the cortical expanse and towards the grey compages of the cerebrum: that is, the corpora striata through the fibers of the medulla of the centrum ovale (corona radiata) which are poured around them in every direction; and the optic thalami through the fibers of the centrum semi-circulare (inner capsule), the corpus callosum and the fornix. In this wise the modes of sensation are directed into every quarter, the upper as well as the lower, the anterior as well as the posterior, of the hemispheres of the cerebrum wherever, indeed, anything of the cortical and cineritious substance shows itself or lies hidden. (The Brain, n. 496.)

In addition to this, in Chap. IX on the fornix and its connections, we read:

These medullary tracts which have respect to the body of the fornix as to the center of their determinations, likewise lend wings as it were to the senses, and their distinct modes, in order to hurry them on in a quick flight towards the superior region of the cerebrum, and at the same time into its whole cortical and grey substance. Thus the sense of sight through the thalami optici is poured out into all that substance whence they spring, and, besides, through the pillars and roots, as well as through the corpus callosum, it is transmitted into its cortical and grey substance, and by these bodies and at the same time by ways around the corpora striata, it is urged into the supreme sphere, where the cerebrum acts as the general sensory and motory organ. The sense of smell also is poured forth towards the corpora striata and the thalami optici, or through the same way whence the olfactory nerves here and there derive their roots it is despatched to the individual origin of each fiber. The senses of hearing and taste also, which from the medulla oblongata by the cerebral peduncles has risen to the striated principles, terminate nowhere else than in the cortical envelope of the cerebrum. The same applies to the sense of touch, which is conveyed by the spinal marrow through the medulla oblongata to the same principles, and thence into the cerebrum, which alone sensates. (*Ibid.*, n. 445.)

The central nuclei of the brain are therefore involved in

the reception of every sort of sensation, but in addition they serve as intermediaries in handing on motor impulses. "The cerebrum is the general motory as well as sensory organ, and it is also the general laboratory of the fluid essences of its body. The optic thalami as well as the corpora striata afford a vicarious aid to the cerebrum in their threefold functions." (*Ibid.*, n. 493.) "In respect to motion. The optic thalami, like the corpora striata, depend upon the sole auspices and beckoning of the cerebrum, and they are not moved until the cerebrum begins to turn the hinges; for the optic thalami are furnished with striæ like the corpora striata but with thinner ones; these striæ also in a like manner flow down from the upper circumference, but obliquely." (*Ibid.*, n. 494.)

These central nuclei, whose convex surfaces form the floor of the lateral ventricles, constrict the cavities of these ventricles when they swell up, and thus govern the motion of the cerebrospinal fluid.

The grey substance of the corpora striata, in respect to the different categories of nerve-elements which enter into their constitution, is, then, one of the most important regions of the encephalon and one of those whose study deserves the greatest care. It receives in its mass a series of nerve-fibers of different providing; the activity of the cerebrum, the activity of the cerebellum, that of the spinal axis, are equally represented there under the form of isolated conductors, and we can say that these three sources of nervous activity are combined intimately in such a way as to constitute a veritable complete *anatomic trilogy*, represented by network of an extreme delicacy and complexity. (Luys.)

The corpora striata are divisible into their intra-ventricular and extra-ventricular nuclei (nucleus caudatus) and (nucleus lenticularis) also assortments of radiating fibers form external, middle, and internal "arcades" of the yellow nucleus, or "anterior efferent fibers" of the red nucleus; and in like manner the optic thalami have their "anterior," "middle," and

"posterior" center, all of which have doubtless their distinctive uses. Here most of the recent investigations appear to agree with Swedenborg's assignment of functions, at least in the main, but as to details there are still some differences of opinion. In his "Iconographie Photographique des centres Nerveux," Dr. J. Luys says:

In relation to the details which we have given on the subject of the agency of the nerve-fibers, we have seen that the central nuclei of the encephalon are connected by the aid of the white fibers to the grey substance of the convolutions and that from the combination of these different nerve-elements results a harmoniously equilibrated apparatus all of whose pieces form a strict unity.

This disposition so simple and at the same time so remarkable, which makes of the optic layer a central nucleus places at the very center of the system whose march and the grouping of the fibers it commands, and whose different points are consequently in connection with all the regions of the cortical periphery, permit us to throw a new light upon the phenomena of cerebral dynamics still so little known. (Text, p. 64.)

The centers of the optic layer represent the veritable *open doors* by which the impressions from without and the visceral impressions pass, before ascending towards the convolutions which are the last term of their successive evolutions. This being admitted, it results from this new conception of the nervous center, that the different categories of sensorial impressions are unequally distributed in the divers departments of the cortical periphery:—that the olfactory impressions, for example, are disseminated more particularly in the grey substance of the hippocampus:—that the optical impressions are above all localised in the anterior regions of the brain:—the acoustic, in the posterior convolutions—and that those of the median center, which is especially the central point of the brain, are disseminated in all the regions of the periphery. (*Ibid.*, p. 65.)

In some respects the "new" idea does not differ so much from Swedenborg's; but although Dr. Luys speaks of the optic thalami as possessing both systems of afferent and of efferent

fibers his thought seems to come back to the more distinctive assignment of sensory functions solely to the optic thalami, while motor offices are confined to the corpora striata, while Swedenborg makes both bodies have dual functions, acting both as receivers and senders. Dr. Ferrier and others who oppose this view lay great stress on the results of vivisectional experiments; but as Dr. Tafel points out:

his assumption that the corpora striata are subservient only to motion, and the optic thalami to sensation, compels Dr. Ferrier in the case of the excision of the two cerebral hemispheres to assume "that impressions of sense made on the organs of sense travel up to the optic thalami, and thence pass directly to the corpora striata," when yet anatomy shows that there are no fibers which pass directly from the corpora striata to the optic thalami, and *vice versa* (see Meynert, etc.); so that in the case of excision by the afferent or sensory fibers of the corpora striata and optic thalami, it must be carried out by the efferent or motory fibers in each of those organs.

It would occupy too much space to describe more than a small part of Swedenborg's additions to our knowledge of the human body. I will confine myself to two more items, quoting first Dr. Wilkinson's account of the theory of the coronary arteries.

It is a curious fact that nearly all the old anatomists, and some also of the moderns, have suspected a puzzle in these coronary vessels. They come from the aorta and run backwards to the heart. In a certain proportion of cases estimated at 5 in 20, one or more of their orifices lies behind the semilunar valves, and such orifices it is clear cannot receive the stream propelled from the heart, because it lays down the valve flat upon them, and effectually closes them. As therefore nature's law must be constant, it was argued, that what holds of one orifice must hold of all and that the blood runs back into the coronaries from the aorta when the heart's contraction ceases. This was Boerhaave's opinion. Morgagni, a more practical anatomist, was more cautious, and requested others to decide the too difficult problem. Another view was now propounded by the celebrated Sweden-

borg. He argued that the raising up of the semilunar valves during the contraction of the heart, when the blood is expelled into the aorta, precludes its passage then into the coronaries; and that the stretching of the coronaries, and their pressure by the full aorta, contributes to the same preclusion. Moreover, that to suppose the heart supplied with blood by regurgitation from the aorta, would be to ascribe to the latter a new action different from what it exerts upon the other blood vessels; nay to claim for it, after the discharge of its functions, a stronger, inverted and retrograde action upon a body the most muscular of any. These considerations led him to infer, that the coronary arteries do not arise from, but terminate in the aorta; that they are veins relatively to the heart, although running into the beginning of the arteries of the body. The doctrine in brief is this:—that the heart as the head of the vessels and the fountain of the blood, itself requires the firstling blood for the exercise of its noble offices, and cannot hold its life by tenure from one of its own arteries, which would be to invert all ideas of the order of nature. The heart is already full of blood, and if fluids, or fluid persons, like solid persons, move with greater velocity in proportion to their life, the best blood in this race will continually outrun the rest, and always first in the heart will skirt along its porous walls. Now what structure do we find upon those walls but caverns, jagged cavities, and at the bottom of these a number of little holes, the foramina of Thebesius. Into these caverns then miniature ventricles in the great ventricle, hearts of the heart, the quickest blood is received, and the pores open with all their hearts to take it in. And when the heart contracts, it drives out the general blood of the body into the grand aorta, but its own particular blood, detained in the cavernous lacunæ, it squeezes, slippery with spirit, through its walls into its muscular substance, and thence onwards and outwards to the surface, into the coronary arteries and the coronary veins, from which there is a reflex, when necessary, into the auricles and ventricles.

It was also held that various currents of blood exist in the heart, and in short a multiple communion, one object of which is the production of a successive order or series of stages in the blood itself, fitting it for its manifold operations. This was

brought to bear upon another subject, namely, the influence of the mind-upon the heart. (The Human Body and its Connection with Man, by James John Garth Wilkinson, pp. 163-165.)

I will conclude with a few passages, selected among many others in the *Regnum Animalis*, which deal with the uses and order of the spleen.

The manner in which the spleen acts upon the blood, is shown by the structure of the spleen; namely, that after throwing the blood out into its cells, all so many little gymnasia and fragibula, it rolls it about, works and reduces it; dashes it from wall to wall; thrashes it, but only gently; throws it out from cell to cell, and in every cell subjects it to a similar exercitation; thus separates the globules from each other, combs down and wipes away accretions and projections or protuberances, tears asunder connected portions, shakes off their bonds, and thus breaks up, loosens and sets free all clots, lamellæ and irregular pieces, leaving the globules naked and distinct. The reason why it eliminates the blood, and throws it, as a thing of no value, out of its paternal vessels and from its native soil, is because no similar place or opportunity for unbinding it occurs in either the arteries, the veins, or the glands; for in the vessels if it be grumous and conglutinated, it is poured around, and remains the same in the narrow passages, relaxing their coats, and weakening their powers of action; still less is there any such place in the glands, into which such blood is not admitted. . . . The fabric of the spleen is sufficient to show, that it cannot break up the blood-globules, but only separate those which are sticking together; for its cellular spaces are too large to act upon the globules individually; besides which, the cellular parietes are not furnished with motive fibers, but are somewhat soft and yielding.

In this connection the following is stated concerning the action of the liver:

That that organ has two functions: 1. That it corrects the hard blood, and breaks it up into its parts for the purpose of renovating it. 2. That it refines the chyle, and inaugurates it into the blood. A third use, that it elaborates and stores up glycocol, or "liver-sugar," and thus acts as a "balance-wheel," or regulator

of forces, was not known at that time. The spleen subserves both these functions by supplying the liver through the splenic vein, *with a blood separated into globules*; for the liver then transmits the hard, antiquated, and stale blood, through the branches of the vena portæ, into the glands where, were it grumous, it could not enter.

In the spleens of oxen and other animals, the same mode of secretion, and of purification of the blood, obtains as in the human spleen, but the mode of discharge is different; that is to say, the blood received, rolled, and reduced therein, is extruded through the continuous cellular partitions, all the way to the surface, and there first taken up by the trunk of the great vein, and by the lymphatics. Whereas in the human spleen it is taken up by the infinite radicles of veins and lymphatics in the very compages and substance of the organ; and this, on account of the excellency of this lymph in man.

The blood which is thus separated and prepared, by means of its structure, situation, connection, *modus operandi*, and peculiar activity, the pancreas invites from the common stream; the spleen from the pancreas; the liver from both; the vena cava from the liver; the right side of the heart from the vena cava; the lungs from the left side of the heart; the whole animated system from the left side of the heart. . . . We have already treated of the structure of the spleen and of its situation, connection, and *modus operandi*, but not yet of the nature of its activity, which seems to be very similar to the activity of the pancreas and of the liver; namely, that like those organs the spleen contracts and constricts its artery and vein, and at the same instant, the cells and glandular acini or vesicles open, and invite the advancing blood to come into their recesses; during which time the foramina leading into the veins appear to be closed; but again, when the spleen and vessels expand, that the cells and glandular clusters contract. That there is such a reciprocation and alternation of motions of expansion and contraction, is proved by the connection of the membrane at the surface with the blood-vessels; and by the continuation and dissemination of that membrane, and of the vessels and nerves, throughout the interior compages of the spleen; for the proper or internal common coat of this viscus penetrates all the way

to the so-called glands, and as in the pancreas and liver, invests them; the capsules being the offspring and production of the ends of both the arteries and the fiber. . . . There are then these three viscera, the liver, the pancreas, and the spleen, whose especial province it is to purify the blood; but the main duties devolve upon the liver. From their association in function, their succession of operations, their connection with each other and the aorta, and from the nature of each, and the power it possesses of demanding its tribute at will from the system, we may now see clearly, that when the spleen is excised, destroyed, or diseased, the pancreas undertakes and sustains a part of its office; the liver, a part; the glands a part and several members of both the abdomen and the thorax, another part. Thus the office of one member is indeed distributed and extended; yet never without danger and loss, and disturbance of that state and order, which the nature of the supreme mind that governs the body, has conferred and established, as being in the highest degree perfect, and harmonious with itself.

The red blood-corpuscles are apt to adhere by their broader faces, forming groups like coins in a roll, thereby diminishing their available free surface and interfering with their function of oxygen-carriers; hence the mechanical action of the spleen as a separator is surely one of its important uses; and since more than a hundred years after this was published, writers on anatomy were saying: "The uses of the spleen are entirely unknown," we must conclude that in this, as in so many other cases, the world has neglected one of its greatest teachers.

It is related of the great teacher, Louis Agassiz, that he was accustomed to lay especial stress upon the obvious, pointing out that the commonplace was very apt to be the most important of all, and should by no means be omitted from our enumeration in drawing up a plan of the scheme of things. Thus he called the attention of a student to the omission in his description of a fish of any mention of the fact that it had bilateral symmetry, with a right and a left side, one the mirror-image of the other. If the importance of such things as these had been generally recognized, it might not have been left for Swedenborg to be the first to point out that there is a universal law of *three*, and *only three*, discrete degrees in all things:

All things which have existence in the world, of which three-fold dimension is predicated, that is, which are called compounds, are constituted according to degrees of height, that is, discrete degrees: as examples will make clear. It is known from regular experience, that every muscle in the human body consists of minute fibers, and these put together into little bundles form larger fibers, called motor fibers, and groups of these form the compound called a muscle.

It is the same with nerves; in these from minute fibers larger fibers are compacted, which appear as filaments, and these passed together compose the nerve. The same is true of the rest of the combinations, bundlings, and groupings out of which the organs and viscera are made up; for these are compositions of fibers and vessels variously put together according to like degrees. (Divine Love and Wisdom, n. 190.)

There are few more all-inclusive generalizations.

CHAPTER XVI

ORDER, SERIES, AND DEGREES

I will lift up mine eyes to the mountains,
From whence doth come my help.
My help is from Jehovah,
Who made the heavens and the earth.

(Psalm cxxi, 1, 2.)

THERE must be a Source of Power, and it must be *One* and undivided, lest actions be at cross-purposes. The Source of Power must act according to *Order*, from first through intermediates to lasts, and must produce *Series* of Discrete *Degrees*. This is Swedenborg's formula as deducible from what is said at the end of Chapter XV and conformable to the evidence of observation. We name this process, according to the point of view: Creation, Development, Evolution,—a meaning essentially the same thing. As to the quarrels which have arisen over the use of terms, I do not propose to enter. By evolution, I do not mean that earlier, pagan and vicious worship of the strongest, mistakenly identified with "the fittest," which has now been so thoroughly refuted that it needs no further refutation by me. Neither do I conceive it to mean an impossible, causeless, and haphazard process; but everything points to and demands the most perfect order.

God's omnipresence from the primaries to the ultimates of the spiritual world, His order is effected by the heat and light of the Sun of the spiritual world, in the midst of which He is. By means of the Sun order was produced; and from it He emits a heat and light which pervade the universe from primaries to ultimates, and produce the life which is in every man and in every animal, and the vegetative soul, which is in every [vegetable] germ on earth, and those two elements flow into all things in general and

particular, and cause every subject to live and grow according to the order imposed upon it by creation. And as God is not extended, and yet fills the whole extent of the universe, He is omnipresent. That God is in all space without space, and in all time without time, that therefore the universe, as to its essence and order, is the plenitude of God, is shown elsewhere; and because this is so, by omnipresence He perceives all things, by omniscience He provides all things, and by omnipotence He effects all things. From which it is plain, that omnipresence, omniscience and omnipotence make one, or that one implies the other, and that thus they cannot be separated. (*Heavenly Arcana*, n. 63.)

Man was created a form of divine order because he was created an image and likeness of God; and because God is Order itself, man was created an image and likeness of order. There are two elements from which order proceeded and by which it continues—divine love and divine wisdom; and man was created their receptacle; wherefore he was also created into the order according to which those two elements act in the universe, and especially according to which they act in the angelic heaven. Therefore that whole heaven is in the largest effigy, a form of divine order, and in the sight of God, like one man. Moreover, there is a binary correspondence between that heaven and man; for there does not exist in heaven any society which does not correspond to some one of the members, viscera, or organs in man; wherefore it is said in heaven that this society is in the province of the liver, or of the pancreas, or of the spleen, or of the stomach, the eye, the ear, or the tongue and so on. The angels themselves also know in what realm of any part of man they dwell. That such is the case it has been granted me to know to the life. I saw as one man, a society consisting of some thousands of angels; from which it was plain [to me], that heaven in the complex is an image of God; and an image of God is a form of divine order. (*Ibid.*, n. 65.)

It must be known that all things which proceed from the Sun of the spiritual world, in the midst of which is Jehovah God, relate to man; and that therefore all things relating to that world conspire to the human form, and present that form in their inmosts; wherefore all objects which there appear to the

eye are representative of man. Animals of all kinds appear there, and they are likenesses of the affections of love, and therefore of the thoughts of the angels; there are also trees, flowers, and green fields there; and the angels are gifted with knowledge of what affection this or that object represents; and what is wonderful, when their inmost sight is opened they recognize their own images in them; and this takes place, because every man is his own love and his own thought from it. And because affections and their thoughts with every man are various and manifold—some of them relating to the affections of one animal, and some to that of another—therefore the images of these affections so appear. But of this more will be seen in the section on Creation. From these statements the truth is evident that the end of creation was an angelic heaven from the human race, consequently man, in whom God can dwell as in His receptacle. This is the reason why man was created a form of divine order. (*Ibid.*, n. 66.)

Before the creation God was Love itself and Wisdom itself, and these two in the effort to accomplish uses; for love and wisdom without uses are only creatures of the reason, which fly away if not embodied in use. The two prior elements separated from the third are moreover like birds that fly above a great ocean, and at length, wearied by flying, fall down and are drowned. Evidently, therefore, the universe was created by God to give existence to uses; wherefore the universe may also be called a theater of uses. And as man is the principal end of creation, it follows that everything and all things belonging to order were brought together and concentrated in him, in order that through him God might accomplish primary uses. Love and wisdom without their third, which is use, may be compared to the sun's heat and light, which, if they did not operate upon men, animals, and vegetables, would be useless, while by influencing into those things and by operating upon them, they become real. For there are three things which follow each other in order, end, cause, and effect; and it is known in the learned world, that the end is nothing unless it regards the efficient cause, and that the end and this cause are nothing unless they become an effect. The end and cause may indeed be considered abstractly in the mind, but yet on account of some effect which the end purpose

and the cause obtains. It is the same with love, wisdom, and use; use is the end which love purposes, and through the cause accomplishes; and when use is accomplished, love and wisdom really exist, and in it make for themselves a habitation and repose, where they rest as in their home. It is the same with the man in whom reside love and wisdom from God when he performs uses; while, that he may perform divine uses, he is created an image and likeness, that is, a form, of Divine Order.

There are three heavens, and these are most distinct from each other: the inmost or third, the middle, or second, and the ultimate or first. They follow in order and are mutually related like the highest part of man, which is called the head, his middle, which is the body, and the lowest, which is the feet; and like the highest, middle, and lowest stories of a house. The Divine which proceeds and descends from the Lord is also in similar order; therefore from the necessity of order heaven is threefold. (*Heaven and Hell*, n. 29.)

He who is unacquainted with the nature of divine order as to degrees, cannot comprehend in what manner the heavens are distinct, nor even what is meant by the internal and external man. Most people have no other idea concerning things interior and exterior, or concerning things superior and inferior, than as of something continuous, or cohering by continuity from purer to grosser; whereas things interior and exterior are not continuous with respect to each other, but discrete. Degrees are of two kinds; namely degrees continuous and degrees not continuous. Degrees continuous are as the degrees of the waning light, from things which are in light to those which are in shade; or as the degrees of purity of the atmosphere, from its lowest to its highest parts. Distances determine these degrees. Whereas degrees not continuous, but discrete, are distinguished like prior and posterior, like cause and effect, and like what produces and what is produced. The careful inquirer will discover, that in all created things whatsoever, and in every part of them, there are such degrees of production and composition; namely, that from one thing proceeds another, and from that a third, and so on. Whoever fails to comprehend these degrees, cannot possibly understand the distinctions of the heavens, and the distinctions of the interior and exterior faculties of man; nor the distinction.

between the spirit of man and his body; and consequently he cannot understand what and whence correspondences and representations are, nor what influx is. Sensual men do not comprehend these distinctions, for they make increments and decrements, even according to these degrees, continuous; hence they are unable to conceive of what is spiritual, otherwise than as purer natural. Wherefore they also stand without and far removed from intelligence. (*Ibid.*, n. 38.)

"Lastly," says Swedenborg,

I am permitted to relate a certain arcanum concerning the angels of the three heavens, which has never before entered the mind of anyone, because no one has hitherto understood the subject of degrees. The arcanum is this: That with every angel and also with every man, there is an inmost or supreme degree or an inmost or supreme something, into which the Divine of the Lord first or proximately flows, and from which it arranges the other interior things which succeed according to the degrees of order with the angel or man. This inmost or supreme [region] may be called the Lord's entrance to angels and men, and His innermost dwelling-place with them. By virtue of this supreme or inmost, man is man, and is distinguished from brute animals for these do not possess it. Hence it is that man, different from animals, can, as to all the interiors of his rational and natural minds (*mentis et animi eius*) be elevated by the Lord to Himself, can believe in Him, be affected with love toward Him, and thus see Him; and that he can receive intelligence and wisdom and converse in a rational manner. It is for this reason also that he lives forever. But what is disposed and provided by the Lord in this inmost [region] does not come manifestly to the perception of any angel, because it is above his thought, and transcends his wisdom. (*Ibid.*, n. 39.)

Everything in nature which exists and subsists from divine order, is a correspondent. The divine good which proceeds from the Lord makes divine order. It commences from Him, proceeds from Him through the heavens successively into the world, and there terminates in ultimates. All things in the world which are according to order, are correspondences; and all things there are according to order, which are good and perfect for use; for every good is a good according to use. Form has relation to

truth, because truth is the form of good. Hence it is that all things in the whole world, and partaking of the nature of the world, which are in divine order, have relation to good and truth. (*Ibid.*, n. 107.)

Some suppose that it would be contrary to divine order for Jesus to be born without a human father, and therefore they deny the Virgin Birth of Jesus. They say that such a birth would be contrary to the "order of nature." But there is no order of nature which is not of divine origin and order.

Again, some say: "We believe that the Lord did have a real human nature, limited in knowledge and power as any human nature is limited."

The Gospels say otherwise: "Jesus did not trust Himself unto them, for that He knew all men, and because He needed not that any should bear witness concerning man; for He Himself knew what was in man." (John II, 24-25.) There *was* a human nature from the mother which was limited, which needed sleep and natural food; but *it was rejected*. Jesus said of *this* life: "Therefore doth the Father love Me, because I lay down my life, that I may take it again. No one taketh it from Me, but I lay it down of Myself. I have power to lay it down, and I have power to take it again. This commandment received I from My Father." (John X, 17-18.)

Jesus had also a second Divine-Natural which was not rejected nor limited, but which was gradually introduced in place of the former, as this was removed, or "laid down."

He Who demonstrated that He was, indeed, the All-powerful Creator, by multiplying the loaves and fishes with which thousands were fed, He Who proved that He knew the laws of the natural world as no scientist of our day knows them, by stilling the tempest, so that the disciples said: "What manner of man is this, that even the winds and the sea obey Him?" (Matt. VIII, 27), He Who showed that He knew the inmost

thoughts of men, both friends and foes, without a spoken word,—He, surely, cannot be said to have had “no other source of superhuman power than we.” If Jesus had put forth all of His superhuman power, it would have been impossible for the Roman soldiers to crucify Him. “Or thinkest thou that I cannot beseech My Father, and He shall even now send Me more than twelve legions of angels? How then should the Scriptures be fulfilled, that thus it must be?” (Matt. XXVI, 53-54.) Consider the mere effect of His personal presence and words! “Jesus therefore, knowing all the things that were coming upon Him, went forth, and saith unto them, Whom seek ye? They answered Him, Jesus of Nazareth. Jesus saith unto them, I am. And Judas also, who betrayed Him, was standing with them. When therefore He said unto them, I am, they went backward, and fell to the ground.” (John XVIII, 4-6.)

From beginning to end, the Sacred Scriptures announce the Coming of the Savior. In Eden was the promise given that the seed of the woman should bruise the serpent's head. In the symbolic language of the Ancient Word, “He shall trample on thy head and thou shalt wound his heel.” (Gen. III, 15.) And as the ages rolled on, the message came more explicitly: “The Lord Himself will give you a sign: Behold a virgin shall conceive, and bear a son, and shall call His name Immanuel,” God-with-us. (Isa. VII, 14.) And the angel of the Lord declared to Joseph that the birth of Jesus without human father, conceived of the Holy Spirit, was to be in fulfilment of this prophecy. (Matt. I, 20-25.)

If we ask further: Who is this Savior? the prophets answer with one accord: The Savior and Redeemer is no less than Jehovah Himself. “The voice of one crying in the wilderness: Prepare ye the way of *Jehovah*; make straight in the desert a highway for *our God*. For the glory of *Jehovah* shall

be revealed, and all flesh shall see it together. Behold, the *Lord Jehovah* will come in strength, and His arm shall rule for Him. He shall feed His flock like a shepherd." (Isa. XL, 1, 3, 5, 10, 11.) The declaration is explicit that He Who called Himself "the Good Shepherd" was none other than Jehovah Himself. "*Jehovah Zebaoth* is His name; and thy *Redeemer, the Holy One of Israel*; the *God* of the whole earth shall He be called," says Isaiah. (LIV, 5.) "I am *Jehovah* thy *God*; thou shalt know no *God* but Me; for there is no *Savior* besides Me," says the word of the Lord to the prophet Hosea. (XIII, 4.) Similar declarations are repeated again and again, and without any exception it is declared that it is Jehovah Himself who would become the Savior of men. "He bowed the heavens also, and came down; and thick darkness was under His feet." (Psalm XVIII, 9.)

By successive veilings of His glory until it could meet the state of finite and sinful men, the All-Father infilled a little child with His most intimate personal presence. Because He would not violate His own law of birth, and because only in that way could He take upon Himself the infirmities of the human and overcome them, He became in turn an infant, a boy whose questions amazed the learned doctors in the temple, and finally the Man of perfect wisdom, infinite tenderness and compassion, and courage beyond comparison. As Son of God, He showed us *all* of the Divinity within Him which it was possible for man to receive. "No man hath seen God at any time; the only begotten Son, who is in the bosom of the Father, He hath declared Him." (John I, 18.)

And finally in that last wonderful prayer: "I glorified Thee on the earth, having finished the work which Thou gavest Me to do. And now, O Father, glorify Thou Me with Thine Ownself, with the glory which I had with Thee before the world was." (John XVII, 4, 5.) Jesus prepared to put off

the Sonship and to enter into the Fatherhood of God, "together with and in His *glorified* humanity." It tells us not

"his own self." The self is the man's own real character, inseparable from him. So here. "Glorify Thou Me with Thine Own Self," means: Let Me be absolutely One with Thee. And this prayer being granted, the Son was no longer distinct from the Father, but is now in Person one and the same with the Father, so that He could say to the disciples, the end being now in sight: "He that hath seen Me hath seen the Father." (John XIV, 9); as He had previously said to the Jews, but not quite with the same absoluteness: "I and the Father are One." (John X, 30.)

The Lord is Order Itself and from Him proceed all the laws of order. "The natural is the ultimate of Divine order and the basis on which things prior or superior rest and subsist." (*Apocalypse Explained*, n. 666.) Whoever thinks that the natural world, its substances, forms, and activities, are of no account and can be dispensed with, ignores the fundamental fact that the wise man is one who builds his house upon the rock. When John on Patmos was permitted to see a representation of the Judgment,—“See! there was a throne set in Heaven; and He that sat was to look upon like a jasper stone, and a sardine; and a rainbow round about the throne, like an emerald to look upon, and around the throne were four and twenty thrones, and upon the thrones I saw four and twenty elders sitting.” (Rev. IV, 2-4.) It signifies “the *ordination* of all things in Heaven for the Last Judgment.” (*Apocalypse Revealed*, n. 233.) And because thrones are mentioned, it means that the Judgment will take place by the establishment of the dominion of the Word of the Divine Truth in which are all of the laws of order. Precious stones are mentioned because judgment is from the living, fundamental foundation

truths of the letter of the Word, on which character is builded.

Unless there is given *Perception* that the Lord Jesus Christ is the One God, the I AM, order is violated and education becomes an inversion, with the result that the Sacred Scriptures are displaced from their supreme position. The doctrine that godless "Nature" and a blind Chance are all that exist, inevitably follows. This usually comes to pass through the evil offices of a logic which usurps the function of perception of the supreme realities, ignores and rejects the foundation stone of our temple of learning, and leads to a false materialistic philosophy with which our present "higher" institutions of education are pretty well saturated.

Without a perception of Spiritual realities, logic interprets facts from false premises. Of what avail is a spurious knowledge resting on falsity? Is it any wonder that a civilization founded on such knowledges shows signs of disintegration? "And even now the axe lieth at the root of the trees; every tree therefore that bringeth not forth good fruit is hewn down and cast into the fire." (Matt. III, 10.)

The New Church must place as its chief object the restoring to the world of a genuine knowledge of God. A New Church education will set its face towards a régime which shall fulfil the prophecy of that coming time when "the earth shall be full of knowledge of Jehovah, as the waters cover the sea." (Isa. XI, 9.)

Ouspensky from his mathematical theory of the "fourth dimension," concludes that, "we have no reason whatever to hope that the relations of 'the other world,' or *the world of causes* can be logical from our point of view. On the contrary, it may be said that EVERYTHING LOGICAL IS NOT OF THE OTHER WORLD, not noumenal, but phenomenal. Nothing can be logical from our standpoint, *there*. All that is *there* must seem to us a *logical absurdity*, nonsense. We must remember

that it is impossible to penetrate there with *our logic*." ("Ter-tium Organum," pp. 263-264.) This book, published by the Manas Press, Rochester, N. Y., 1920, has a decidedly pagan and pantheistic flavor, yet it reaches many conclusions which are in agreement with those of the New-Church doctrine. But are we not promised that "the abundance of the sea shall be converted unto thee, the forces of the gentiles shall come unto thee." (Isa. lx, 5.)

Swedenborg asserts in his "Worship and Love of God," that the forms of the lowest atmosphere of the spiritual world are related to the vortical forms of the highest aura of nature by the addition of another dimension. Zöllner, whom we have before quoted, in experiments conducted with the aid of the medium, Slade, obtained results which could only be explained on the supposition that the "space" of the spiritual world has more than three dimensions, that is, it differs totally from natural space. Zöllner's experiments (to which he gave the name of "Transcendental Physics") were witnessed in several cases by the distinguished student of electricity, W. Weber, and the psychologist, Fechner. The results are certain. They cannot be denied without rejecting all human testimony. Yet they completely overthrow our ordinary logic.

From experience Swedenborg tells us, that in the spiritual world the creation of animal forms, which would require enormous ages of evolutionary development in our world, takes place instantaneously, time being annihilated. Similarly he found that widely separated spirits had only to desire to meet and were immediately in each other's presence. Distance was annihilated by the power of love. Again, on entering his heavenly society, a newcomer, while retaining his individuality, immediately becomes possessed of the wisdom of his associates, or is identified with the whole, because he has entered into *the all*, or his life has become one with that of the whole.

This traverses the ordinary logic which sees the part as necessarily less than the whole. In fact, the laws of our logic cannot act in the spiritual world, but new laws take their place. Ouspensky, in the aforesaid work, tries to place these noumenal laws in the form of a "higher" logic, and arrives at the same conclusions as those just cited from Swedenborg; but Swedenborg (whom he does not mention) based his statements on experience without any theorizing, which is much more satisfactory and ought to convince even those who demand ocular evidence for all beliefs. Here we have the ocular evidence of a scientific witness of splendid training, thoroughly prepared for the quest and fully informed in regard to the make-shifts and illusions of the former "philosophies." And in these disclosures we have a solid foundation for our new education.

We are going to consider the laws of spiritual science, or the laws of order, all of which flow from the Lord Who is their Source. Since science demands exact statements of truth, it is necessary that we should employ a few technical terms. All science does the same. Let us begin therefore with a few definitions: By "celestial" we mean, relating to the love of God and its reception and perception by finite beings in whom is the quality of being "heavenly minded," loving, and forgiving. By "spiritual" is meant, having thirst for the truths of heaven and comprehension of them by the higher faculties of the understanding, as will best be seen in the illustrations which are to follow. By "natural" is meant, in the good sense, a state of mind and life in which heavenly truths and laws of "order" are *obeyed*, even if they are not entirely understood. It is the state in which even the best men and women are apt to remain during life on earth. But if we are "faithful unto death," Jesus will give us "the crown of life," and will elevate such as have prepared themselves by living accord-

ing to the truths they know, into the higher degrees of wisdom or of love.

To see the naked truth is to comprehend rationally the law of Divine Order. But there are as many ways of order, Swedenborg tells us, as there are truths in the Word of God. It is the universal principle of Order, otherwise called the laws of Divine Wisdom, which constitute the genuine meaning of the Sacred Scriptures—a meaning hidden from the natural man, but patent to the spiritual man. For this reason Swedenborg calls it the *spiritual sense*.*

But as of old, the testimony of the Lord's prophet has not been received, even as Jesus said: "Behold, I send unto you prophets, and wise men, and scribes. Some of them shall ye kill and crucify; and some of them shall ye scourge in your synagogues, and persecute from city to city; that upon you may come all the righteous blood shed on the earth, from the blood of Abel the righteous unto the blood of Zachariah, son of Barachiah, whom ye slew between the temple and the altar." (Matt. XXIII, 34-35.)

The commandment, "Thou shalt not kill," in the NATURAL SENSE means not to *kill* man, or to inflict upon him any wound from which he may die, also not to mutilate his body; and moreover, *not to bring any deadly evil upon his name and fame*, since with many fame and life go hand in hand. [It will be noted that in this respect a man may be "killed" after he is physically dead, by assailing his reputation, and that this is also, when committed unjustly and knowingly, constitute murder, though we distinguish different degrees of this crime. In a broader natural sense, murder means enmity, hatred and revenge, which tend to murder, for in them it lies concealed as fire in wood under ashes; infernal fire is nothing else. . . . In the SPIRITUAL SENSE murder means all modes of killing

*M. Henri de Geymuller in *Revue de l'Ere Nouvelle*, No. p. 325. (July-September, 1921.)

and destroying the Souls of men, which modes are various and manifold, as turning them from God, Religion, and Divine Worship, by throwing out scandal against these, or by such persuasions as cause aversion and even abhorrence. . . . In the CELESTIAL SENSE, to kill means to be rashly angry with the Lord, to hate Him, and to wish to blot out His name." (*True Christian Religion*, n. 309-311.)

Since all order flows from God for the sake of heaven, it is most essential that we should have correct ideas of God and of heaven, and should be instructed from the spiritual sense of the Word. Few realize what a vacuity, what a veritable spiritual famine is with this people.

Says a recent writer, Rev. Karl Reiland, Rector of St. George's Church, New York, as reported in the *Boston Transcript* for April 10, 1926:

It is a fair question to ponder if the conviction of immortality has anything to do with the quality of the life we live. Is it possible that in proportion as we bring into life things worth being eternal, our sense of eternity and the personal survival of death is calculated to grow? Taking the long evolutionary view one is inclined to think this is a reasonable assumption. The greatest question in the world is the question of living on, or not living on, after the event which we call death, and which is the surest event facing all of us. We do not live in daily contemplation of this event, as so many of the old tombstone warnings bid us to do, but go about our business, quite calmly indifferent to the great taking-off. This fact in itself is interesting and may be freighted with significance, especially when we recall the words of Jesus, "Take no thought for the morrow . . . sufficient unto the day is the evil thereof." Perhaps we are not meant to think much of death because of its incidental character. Then, too, if this present life is all there is to life; if when we die we become extinct—no more—what is the meaning of the whole majestic, mysterious, thrilling universe of living things, of loving beings, of beauty and ideals? No wonder man "thinks he was not made to die," and thinks it because of some ocean-deep

instinct which he cannot resist or thrust aside, which rises up at times and surges over his consciousness, leaving him no answer but flooding his spirit with aspiration.

This is true enough, but it simply shows that the so-called "Christian" church of this day no longer believes in the teachings of Jesus and has no more knowledge of *immortality* than the Sadducees of old. It is all an "assumption" and a "question" with one who claims to preach the gospel, but who succeeds only in involving the Savior's words: "I am the Resurrection and the Life," in doubt and obscurity. What Mr. Reiland calls "the greatest question in the world" is cited, yet its solution is declared to rest on nothing but questionable assumption! And such assertions are continually being made by men high in authority in their church.

In the face of such teaching as this, the great student of plant evolution, Luther Burbank, is to be commended for declaring that he will have nothing to do with *such* a church and with such a *blind* faith; though he might have inquired further for a better one.

All the critics of Burbank have nothing to offer that can possibly build up the faith of an intelligent man who has lost his belief in orthodox doctrines. There rises the cry of "faith." But the faith there meant is a blind belief in something the church has taught, without any rational proof that it is true. Calls for such a blind faith will have no effect on the doubting scientists.

The original faith of the Church was built on evidence. It was like the blind man whose eyes were opened, who said, "Whereas I was blind, now I see."

Swedenborg teaches a *seeing faith not a blind faith*. In the *Doctrine of faith*, he says:

"Real faith is nothing else than the acknowledgement that a thing is so, because *it is true*. Accordingly one who is in real faith thinks and says, this is true, and for that reason, I believe it. For faith belongs to truth, and truth is (the object) of faith. Such a person, also, if he does not comprehend a thing as true, says, I do not know whether this is true; therefore I do not yet

believe it. How can I believe what I do not comprehend? It may possibly be false."

Swedenborg throughout his theological works offers logical proof of every subject with which he deals [i.e., where the subject is capable of such proof]. Eventually all rational minds seeking truth regarding spiritual matters must turn to him for he alone gives us the ladder by which one may ascend from the natural to the spiritual. (Rev. John Whitehead in *The Swedenborg Student* for March, 1926, pp. 44-45.)

If any have had their minds abused and their spiritual life invaded by false reports of the Lord and His messenger, let them now put off all prejudice and receive the healing leaves of the Tree of Life. Perchance they have cast away those leaves unknowingly and without blame. For verily "the leaves of the Tree were for the healing of the nations." (Rev. XXII, 2.) Let them revise their hasty opinion.

The laws of heavenly, or Divine Order, are first given in the Sacred Scriptures in the parable of the four rivers of Eden, and then in the Spiritual Sense of the twelfth chapter of Genesis.

From the first chapter of Genesis thus far, or rather to the mention of Eber, the stories have not been true history, but composed history, signifying in their internal sense celestial and spiritual things. But in this [the twelfth] chapter and in those that follow, the stories are not composed, but true histories; and these in like manner signify celestial and spiritual things, in the internal sense; as may be evident to any one from this alone, that it is the Word of the Lord. (*Heavenly Arcana*, n. 1403.)

In the first verse of this chapter we read:

And Jehovah said unto Abram: Get thee out of thy land, and from thy nativity, and from thy father's house, to the land which I will cause thee to see. These and the things which follow occurred historically, as they are written, but the historic facts are representative and each word is significative. By Abram in the internal sense is meant the Lord. . . . By "Jehovah said unto Abram" is signified the very first observation of the mind. "Get

thee out of thy land" signifies corporeal and worldly things, from which he was to recede; "and from thy nativity" signifies the more external, corporeal, and worldly things; "and from thy father's house" signifies the more internal things of a like sort; "to the land which I will cause thee to see" signifies the things spiritual and celestial which were to be presented to view. (*Ibid.*, n. 1407.)

We are told by Swedenborg that in the deepest and holiest sense, these things which are related in the letter concerning the patriarch, tell us in symbolic language about the Incarnation of Jehovah in the person of the Lord Jesus. But in a less deep, though still interior sense, they have an application to each one of us and are for all time.

Man begins life in worldly and corporeal experiences. These are his native land. But to each of the children of men there comes at some time, sooner or later, the command: "Get thee out of thy land, and from thy kindred, and from thy father's house, to the land that I will cause thee to see." The father's house, here, is the old selfish life to which we are prone. We are commanded to go to a "*new* land," to embrace a higher life in place of the merely worldly one. Jesus, when on earth, was continually putting off the things of natural and worldly life and bringing down the Divine in their place, until when the last of the finite was put off, He could utter his memorable cry: "It is finished." And we who are called to follow Him in the abandonment of our native land of selfishness and worldliness, and to replace our first loves by heavenly affections for what is of heavenly life, must not falter until the end.

The story of Abraham's journeyings, when interpreted spiritually, is full of the deepest significance. This is explained in the "Heavenly Arcana."

Coming to the books of Moses, Joshua, the Judges, Samuel, and the Kings,

in all these nothing is apparent but mere history; still in the internal sense are arcana of heaven which lie stored there, and which can never be seen so long as the mind, with the eye, is confined in the histories; nor are they revealed until the mind is removed from the sense of the letter. The Word of the Lord is like a body in which is a living soul. The things belonging to the soul do not appear while the mind is so fixed in corporeal things that it scarcely believes that there is a soul, still less that it will live after death; but as soon as the mind withdraws from corporeal things, those which are of the soul and life are manifest. This is the reason, not only that corporeal things are to die before man can be born anew, or be regenerated, but also that the body is to die so that he may come into heaven and see heavenly things. So it is with the Word of the Lord: its corporeal things are those which are of the sense of the letter, and when the mind is kept in them, the internal things are not seen at all; but when the former are, as it were, dead, then first the latter are presented to view. But still the things of the sense of the letter are similar to those which are with man while in the body, that is, to external knowledges in the memory which are from the things of sense, and are common vessels containing things interior or internal. It may be known from this that the vessels are one thing and the essentials contained in the vessels another. The vessels are natural; the essentials contained in the vessels are spiritual and celestial. So likewise the histories of the Word and the particular expressions in the Word are common, natural, and indeed material vessels, in which are things spiritual and celestial; and these in no wise come into view except by the internal sense. This may be evident to everyone from the mere fact that many things in the Word are said according to appearances, and indeed according to the fallacies of the senses, as, that the Lord is angry, that He punishes, curses, kills, and many other such things; when, nevertheless, in the internal sense they are quite the contrary; namely, that the Lord is in no wise angry and punishes, still less does He curse and kill. And yet, to those who from simplicity of heart believe the Word as they apprehend it in the letter, no harm is done while they live in charity. The reason is that the Word teaches nothing else than that everyone should live in charity with his neighbor, and love the Lord above all things. They who do this

have in themselves the internals; and so with them the fallacies taken from the sense of the letter are easily dispersed. (*Ibid.*, n. 1408.)

When it is finally comprehended that in the Sacred Scriptures, or Word of the Lord, is hidden a wonderful internal sense which clears up all of the seeming discrepancies of the letter and which has an inexhaustible wealth of meaning, with answers to every conceivable question regarding spiritual realities, we shall wish to put these things to the test.

Let us take a single example: The suggestion which Abram makes to his wife in the thirteenth verse of this twelfth chapter, that she shall tell the Egyptians that she is his sister, a statement which, being in a sense a prevarication and intended to deceive, we should call deceitful or immoral according to higher standards of life, and as to which those who know only the literal sense are apt to question, saying, Can *this* be the Word of God or have any lesson for us? The spiritual sense supplies an answer to these questions. To one who hears of these things for the first time, the significances attached to the several terms may seem arbitrary, or perhaps even fanciful; but when the reasons for them are known from further study, with evidence that even in its minutest details the signification is borne out, and especially when it is found that the Sacred Scriptures consist of books which were written many ages apart and by many different prophets, each of whom professed to write not his own thoughts, but those which were given him as the Lord's amanuensis, when it is found that throughout these books there runs a perfectly continuous *spiritual* narrative, that these symbols are used again and again by different amanuenses with precisely the same signification, the wonder of it increases and the conviction becomes certainty, that here is indeed the hand of God, that there must be a God Who is one in essence and in person and Who is Infinite, Omniscient,

the I Am, the Divine Man, and Who is the Author of the Holy Word from beginning to end. When we consider the vicissitudes through which the manuscripts must have passed, the preservation of these minute peculiarities of the Word on which the spiritual sense hangs, is as much a miracle as any of those that have aroused critical discussion among doubters. The utter failure to comprehend the essentials of the structure of the Word is responsible for most of the criticism which has been aimed against it.

The marvelous story of the childhood of Jesus, told in symbols, proceeds from verse to verse until we come to verse nineteen, where Pharaoh, King of Egypt, asks Abram: "Why saidst thou, she is my sister?" Here we are shown that a sister denotes intellectual truth, but a wife truth conjoined to the celestial, and the former state must precede, where there is order.

"If the progression be made from knowledge and rational truths to celestial truths without the medium of intellectual truths, the celestial is violated. . . . Order is, that the celestial shall flow into the spiritual and adapt it to itself; the spiritual will thus flow into the rational and adapt it to itself, the rational will thus flow into knowledge and adapt it to itself. But when a man is being instructed in first boyhood, the order indeed is then similar, but it appears otherwise. . . . Celestial and spiritual things are continually coming forth, and are also preparing and forming for themselves the vessels which are being opened." In thought and the faculty of judging "lie hid all the arcana of analytical art and science, which are so many that they can never be explored even as to the ten-thousandth part." (*Ibid.*, n. 1495.)

The statements of spiritual science, like many of those of natural science, cannot be understood at a glance, but must be studied, in this case in connection with several pages of further

explanation, which would be interesting but on which we will not dwell.

Then a second time, Abraham, in his relation with the King of Gerar, says that Sarah is his sister. In defending himself against Abimelech's reproaches, Abraham explains that Sarah is indeed his half sister, since they had the same father but different mothers. This circumstance, sufficiently extraordinary in itself as a natural fact, is found to contain profound spiritual significatives. Fully as remarkable is the narrative that, long afterward, Abraham's son Isaac practiced a similar deception on the King of the Philistines, by passing off his wife as his sister, possibly having learned the trick from his father. Herein we see the difference between sacred history and what is called "profane" history. The latter seeks to cover up the misdeeds of its heroes; but the sacred narrative is absolutely truthful and reveals the inmost secrets of the heart of man. Yet underneath these appearances are hidden heavenly truths, concealed in symbols so that they may not be profaned, and awaiting the time when they may be safely revealed. The equivocal statements of the letter are here necessary in order that they may contain these spiritual truths in a veiled form for their preservation. The affection for truth, represented by these women, is at first received very imperfectly. It is only a sister. But when embraced with all the heart, it becomes a wife.

Similar things are told of the two patriarchs, yet with a difference, because they represent different spiritual principles. In the inmost sense the story of Abraham tells us of the innocent life of the little Lord Jesus in infancy and early childhood. The story of Isaac carries the narrative farther on into the development of intellectual life in boyhood, when, at twelve years, Jesus went into the temple and talked with the doctors, "both hearing them and asking them questions." Because

Abraham stands for the things of celestial love, much is said about his flocks and his herds, because these animals represent good natural affections and brotherly love from their habit of flocking together. But of Isaac, who denotes the spiritual things of the intellectual principle, it is related how the lonely man, walking in the fields at eventide and meditating after the death of his mother, "lifted up his eyes, and saw, and, behold, the camels were coming," bearing for him all that was to be most precious in his life. Camels correspond to affections for science, and knowing that Isaac represents the spiritual of the intellectual principle, we see why this chapter (XXIV) is full of camels. And when the story of the prevarication as to sister and wife is seemingly repeated, we find that in the spiritual sense there is an essential difference, and that it tells us that natural science cannot discover for itself the things of the kingdom of God. The rational is a "sister" and not a "wife." (See *Heavenly Arcana*, n. 1475; n. 2524.) There are still other things about Rebecca, who represents the Divine Truth, beloved by Isaac.

The repetition of what seems like the same story is on account of the great importance of the spiritual principles involved, and is not a mistake, as an obtuse literal criticism might aver.

"Isaac's saying that Rebecca was his sister, as Abraham had before said that Sarah was his sister, first in Egypt, and afterward in Gerar, involves a like arcanum, as may be seen from the explication of these passages, and inasmuch as the like happened three times, and is also three times recorded in the Word, it is evident that it is an arcanum of the greatest moment, which cannot be known to anyone but from the internal sense." (*Ibid.*, n. 3386.) Because of its importance this arcanum has been explained by Swedenborg at great length.

We learn from these teachings that in the whole Sacred

Scriptures, the Inmost Sense is about the Lord, Jehovah-Jesus that He would come into the world in the fulness of time to save the human race, and that all things would be accomplished according to *Heavenly Order*. To sum up: Man was created according to heavenly order and remained in that order until by the domination of corporeal and natural things over spiritual and celestial ones, that order was destroyed.

How shall we return into the true order? Jesus says: "Seek ye first the Kingdom of God," which includes order from the reception of truths, usefulness, and the moral virtues:—kindness, gentleness, patience, cheerfulness, forgiveness, contentment, trust,—in a word, love.

Instruction must precede. We need a new distribution of values, a new education. An education based on the principles of heavenly order will elevate love and service to the supreme place, and will cast out cruelty and self love. Whoever will give to the reading of that wonderful book, the "*Heavenly Arcana*," say, an hour a day, will soon find that the Bible has become a new book to his gradually opening mind. Such reading of the "*Arcana*" means more than a flippant glance through its pages. This is genuine spiritual science. It cannot be mastered without faithful study. Read "*The Bible that was Lost and is Found*," by Honorable John Bigelow.

The supreme end of creation is the formation of a Heaven of Angels from the human race. As the Heavens increase by stronger influx and interaction upon our life, the level of human life on earth will rise. Yet earth must coöperate, and man's best efforts ought to be given to help establish the highest life of which we are capable.

Man is "*in order*" when he suffers himself to be led by the Lord, for this is the heavenly order. . . . But when man does not suffer himself to be led by the Lord . . . he is in the opposite order; *evil* with falsities is in the middle; truths

are rejected to the circumferences, and the veriest Divine truths themselves to the ultimate ones—this order is infernal.” (*Arcana*, n. 4552.)

Swedenborg teaches that all power resides in ultimates, because it does not really exist until it has descended from firsts to lasts through a series of degrees. But the power does not *begin* from ultimates, although, as he says, it *appears* otherwise. In reality, all power is from above. “*I will lift up mine eyes to the mountains.*” Just as the sun appears to go around the Earth, when the reality is exactly the opposite, so to the uninstructed, creation appears to originate in matter, when the order of creation is this: *Spirit, Energy, Matter*. These are discrete degrees in descending order.

Series of created forms appear in the natural world,—from mollusks to man, from seaweeds to roses, lilies and palm trees, but the *series* referred to here are of a different sort. They are series of productive and sustaining degrees, called by Swedenborg, “Discrete Degrees.” The exhaustive treatise with this title, by Rev. N. C. Burnham, should be studied by anyone who would familiarize himself with this subject.

In his earlier scientific work—the “Economy,” etc., Swedenborg had a vague conception of a “Doctrine of Series and Degrees, or the Doctrine of Order”; but as he had not then escaped from the tutelage of the metaphysicians, he has little to tell us that is of interest. In *True Christian Religion*, n. 351, he gives a more lucid explanation of his idea of series:

To show what is meant by series and fascicles, we will explain: the first chapter of this book [T. C. R.], which treats of God the Creator, is divided into a series of sections, the first of which is on the Unity of God, the second on the Being of God, or Jehovah, the third on the Infinity of God, the fourth on the Essence of God (which is Divine love and wisdom), the fifth on the Omnipotence of God, and the sixth on Creation. Again the subdivisions of each section form series, binding together its

contents in one group. These series in general and in particular, that is to say, conjointly and separately, contain truths, which, according to their abundance and coherence, exalt and perfect faith. He who does not know that the human mind is organized, or that it is a spiritual organism terminating in a natural organism, in and according to which the mind produces its ideas or thinks, cannot but suppose that perceptions, thoughts, and ideas are nothing but radiations and variations of [spiritual] light influent into the head, and presenting the forms which man sees and acknowledges as reasons. But this is foolishness; for everyone knows that the head is full of brains, that the brains are organized, that the mind inhabits them, and that its ideas are fixed therein, and are permanent to the extent that they are accepted and confirmed. The question is, therefore, What is the nature of that organization? The answer is, It is the arrangement of all things in series, as it were in fascicles, and that the truths belonging to faith are so disposed in the human mind. That it is so may be illustrated as follows: The brain consists of two substances, one of which is glandular, and is called the cortical and cineritious substance, and the other fibrillous, and is called the medullary substance. The first, or the globular substance, is formed into clusters like grapes on a vine; those clustered formations are its series. The second, or the medullary substance, consists of perpetual collections of little bundles of fibers issuing from the glandules of the former substance; these collections are its series. All the nerves proceeding from the brain and passing down into the body for the performance of various functions, are nothing but groups and bundles of fibers; so are all the muscles, and in general all the viscera and organs of the body. All these are of such a nature, because they correspond to the series in which the mental organism is arranged. Moreover, there is not anything in universal nature that is not formed into series composed of little bundles; every tree, every bush, every shrub and plant, nay, every ear of corn and blade of grass in the whole and in the part, is so formed. The universal cause is, that such is the confirmation of divine truths.

The spirit consists of the mind and the spiritual body. The mind (a) is the higher and dominant part and is therefore the very man himself; the spiritual body (b) which is the lower

part, being a derivative from the mind, is like the mind in form and quality.

The mind is the primal organism. The spiritual body is formed from it and is its organ of sense and instrument of action in the spiritual world. These together clothe themselves with the material body. . . . When the mind, the spiritual body, and the natural body have been thus successively produced, they then subsist simultaneously one within another,—the highest in successive order and thus the essential organism and the first recipient of life in the series, while the lowest becomes the outmost, the containant and the preservative of those within.

Things superior and inferior are the same as things interior and exterior, superior and inferior relating to the order of creation, interior and exterior to the order of preservation.

That the mind, the spiritual body, and the natural body are produced in successive order and sustained in simultaneous order, was shown above.

Conceive now the existence of these two orders in the work of regeneration and salvation.

Love and wisdom, good and truth, charity and faith, are implanted in the mind as the first and fluent principles of the new life. These are from "the breath of the Lord" and are breathed into the mind in their initial forms when the Lord creates man anew in the womb of the Church, his spiritual mother. And being too evanescent to abide in form without a firmer clothing than is supplied by the delicate substances of the mind, they descend into the spiritual body and take on therein a more ultimate form suited to sensation and action in the spiritual world; and descending a step lower, even into the material body, the very ultimate plane of human life, they there clothe themselves with a form suited to the natural world, and thus become fixed and enduring. The order has now become simultaneous. Within the renovated natural body exists the renovated spiritual body and within the spiritual body the central forces of the regenerate mind. Surveying this regenerate state from within out we behold love and wisdom in the mind their primal abode, love and wisdom clothed in their firmer organism in the spiritual body, and lastly love and wisdom embodied in fixed form in the very outmost degree such that it can and will preserve the

interior and inmost in form and order to eternity. (Burnham, *loc. cit.*, pp. 17-18.)

The doctrine of Ultimates is likewise deeply involved in the doctrine of degrees. Ultimate degrees of life are most external and fixed forms in all creations. Comparing the three degrees or kingdoms of life in nature, the mineral kingdom is the ultimate degree. In the trine atmospheres of aura, ether, and air, the air is the ultimate; in the trine, soul, spirit, and body, the body is the ultimate. No creations are effected except in ultimates. Nothing can be said to exist until it has such a form. All things in the spiritual exist simultaneously with their ultimate forms in nature; that is to say, all causes are in the spiritual producing effects in the natural world. The two worlds do not exist apart, but together. A spiritual form could not stand alone without its ultimate as a support and basis. Spiritual things have no force outside of their appropriate ultimate degree of life. Without its ultimate degree the spiritual degree would cease to exist; just as without the letter of the Word the spiritual contents would be dissipated; or just as without conformity of a man's life to the principles of righteous living, true religion with him must perish. In every divine work there is a trinity of form receptive of life, and always the last degree is the ultimate [or lowest]. Man's natural every day life in the world is his ultimate degree. In the trine degrees of willing, thinking, and doing, doing is the ultimate. (O. L. Barler, "Degrees of Life in Man," pp. 86-87.)

"Divine Love and Wisdom," article "Ultimate," as summarized in Potts' *Swedenborg Concordance*:

In the forms of uses in the vegetable kingdom the image of creation appears in this,—that from their primes they proceed to their ultimates, and from the ultimates to the primes. Their primes are seeds; their ultimates are stems clothed with bark; and through the bark, which is the ultimate of the stems, they tend to seeds, which . . . are their primes. . . . The stems clothed with barks relate to the Earth clothed with earths; from which come forth the creation and formation of all uses. . . . The image of creation in the forms of uses is exhibited in the progression of their formation from primes to ultimates, and from ultimates to primes. . . . (Thus) it is evident that the

progression of the creation of the universe has been from its Prime, which is the Lord encompassed with the [spiritual] Sun, to ultimates which are earths; and from these through uses to its Prime. . . . (n. 314.)

In the forms of uses of the animal kingdom there is a like image of creation, in that from seed . . . there is formed a body, which is its ultimate; and that when this grows up, it produces new seeds. . . . From this parallelism it is evident, that, as there is a likeness of creation in the forms of plants, so also there is in the forms of animals, in that there is a progression from primes to ultimates, and from ultimates to primes. . . .

A like image of creation comes forth in each thing which is in man; for there is a like progression of love through wisdom into uses; thence a like one of the will through understanding into acts; and a like one of charity through faith into works. The will and the understanding, and also charity and faith, are the primes from which the acts and works are the ultimates; and from these through the delights of uses a return is made to their primes. . . .

A like progression from primes to ultimates, and from ultimates to primes, is exhibited in the forms most purely organic of the affections and thoughts with man; in his brains there are those star-like forms called the cineritious substances; from these go forth fibers through the medullary substance by the neck into the body, which pass on to ultimates there, and from the ultimates return to their primes; the return of the fibers to their primes is made through the blood-vessels.

There is a like progression (from primes to ultimates) of all the affections and thoughts, which are changes and variations of the state of these forms and substances; for the fibers which go forth from these forms or substances are comparatively like the atmospheres from the spiritual Sun, which are the containants of heat and light; and the acts from the body are like the things which are produced from earths through the atmospheres. (*Loc. cit.*, n. 316.)

From Swedenborg's *Conjugal Love*:

As they perceived that the novitiates wanted to know whether in Heaven there are the like ultimate deliciousnesses, they said that they are exactly like, but much more blessed, because

angelic perception and sensation are much more exquisite than human. . . . It is a universal law that primes come forth, subsist and persist from ultimates; so also is it with this love; and therefore unless there were ultimate deliciousnesses, there would not be any deliciousnesses of conjugal love. (n. 44, p. 8.)

From these things it can be seen that conjugal love, from the first beginnings of its heat, must be elevated out of the lowest region of the mind into the higher region in order that it may become chaste; and that thus from what is chaste it is let down through the middle and the lowest region into the body; and that when this is done, by the descending chasteness this lowest region is purified from its unchaste things; and hence the ultimate of that love also becomes chaste. (*Loc. cit.*, n. 305, p. 2.)

But the most telling message which Swedenborg has given us concerning the source of power and that it is from the Divine truth in ultimates, is from the Doctrine of the Sacred Scriptures:

That the Lord came into the world in order that He might infill all things of the Word, and thereby become Divine truth or the Word also in ultimates. . . .

(This) is meant by these words in John: "The Word has been made flesh, and has dwelt among us, and we have seen His glory." . . . (i, 14.) "To become flesh" signifies to become the Word in ultimates. . . .

His quality as the Word in ultimates, He showed to His disciples when He was transfigured. . . .

The Lord as the Word in ultimates is described in Rev. I, 13-16; where all things of the description of Him signify the ultimates of Divine truth, or of the Word.

The Lord had indeed been the Word before, but in primes. . . . But when the Word had been made flesh, then the Lord became the Word in ultimates also. It is from this that He is called "the First and the Last." (*Loc. cit.*, n. 98.)

The reason (an angelic) mind cannot be formed except in man, is that all Divine influx is from primes into ultimates; and, through the connection with ultimates, into mediates; and thus does the Lord connect all things of creation, wherefore also He is called "the First and the Last." This also was the reason why He came into the world, and put on a human body, and

also glorified Himself therein, in order that from primes and at the same time from ultimates He might rule the universal Heaven and the universal world. It is the same with every Divine operation; that it is so is from the fact that all things coexist in ultimates; for all things which are in successive order are there in simultaneous order; and therefore all things which are in the latter order are in continual connection with all things which are in the former order; from which it is evident that the Divine in its ultimate is in its fulness. . . . Hence it is evident that all Divine operation passes through to ultimates, and there creates and operates. . . .

That an angelic mind is formed in man, is evident from . . . [the fact] that it is from a law of Divine order, that all things should return from ultimates to the prime from which they are. (*Concerning the Divine Wisdom*, VIII, 3.)

Mr. Burnham has gathered together nearly everything which Swedenborg has told us about "the limbus," illustrating it by one of his colored diagrams which "presents a view of the LIMBUS which man derives from the purest substances of the natural world and which he retains as a *cutaneous envelope* of his spiritual body after death. This cutaneous envelope is called *Limbus* in the Latin of *True Christian Religion*, n. 103, where we read,—

The soul, which is from the father, is the man himself, and the body, which is from the mother, is not in itself the man, but from him. The body is only the clothing of the soul woven of such [substances] as are of the natural world; the soul is of such [substances] as are in the spiritual world. Every man after death lays aside the natural [body] which he carried from the mother, and retains the spiritual which was from the father, together with a certain *Limbus* of the purest [substances] of nature around it.

The degrees *A B C* and *D* combined, represent the whole of the spiritual part of man, that is, all which is composed of spiritual substances, (T. C. R., 103, D. L. W., 388), *A* representing the supreme degree or soul-proper; *B* the internal or spiritual mind with its degrees; *C* the external or natural mind

with its degrees; and *D* the spiritual body, consisting of the spiritual sensual and spiritual corporeal.

The limbus *E* and gross body *F* together constitute the entire natural or material body,—the limbus being nearer to the spirit and invisible to the natural eye, the gross body more external and rejected at death. . . .

This limbus man does not cast off at death but retains as a permanent cutaneous envelope of his spiritual body. The substances of the limbus are the natural substances meant in *Divine Love and Wisdom*, where we read,—“The natural mind of man consists of spiritual substances and at the same time of natural substances; from its spiritual substances thought is produced but not from its natural substances; these [natural] substances recede, or pass from activity to quiescence when man dies, but not the spiritual substances, wherefore that same natural mind after death when man becomes a spirit or an angel, remains in a form similar to that in which it was in the world. The natural substances of this mind which as was said recede by death, make the cutaneous envelope of the spiritual body in which spirits and angels are. By such envelope which is taken from the natural world, their spiritual bodies [permanently] subsist, for the natural is the [fixed] containing ultimate.”—D. L. W., 257.

The limbus is described in the same work as *something fixed containing the spiritual organism*:

“The material form [or natural body of man] which is added and superinduced [upon the spirit] that man may do uses in the natural world, and also that he may carry with him [after death] from the purer substances of the world, something fixed containing his spirituals, and so continuing and perpetuating life.”—D. L. W., 388.

And in *Divine Providence*, we read,—“Man by death puts off the grosser [substances] of nature and retains the purer, which latter are next to his spiritual and these are then his containants.”—D. P. 220.

The necessity of a limbus composed of natural substances to keep the spiritual body in form and order arises from the difference between natural substances and spiritual substances. This difference also necessitates the natural world to contain

and preserve the spiritual world. The substances of which the bodies of spirits and angels are composed, being interior and evanescent, not ultimate and fixed like material substances, require an envelope of natural substances to hold them permanently in form. But even this natural cutaneous envelope could not preserve the spiritual body of an angel or spirit, in form, were not the envelope itself contained within and resting upon something firmer and more solid than itself, that is, upon the finer substances and through them upon the grosser substances of the natural body of man. (L. J., 9.) The evanescence of spiritual substances may be illustrated by the escapement and diffusion of fluids in the natural world. The whole physical body to his spirit, and the highest or inmost plane of this physical universe is related to the spiritual universe as man's limbus to his spirit. The inmost plane being the nearest covering of the spiritual universe must be the medium by which the life of the spiritual world flows into and operates upon all lower natural substances which constitute the gross physical body of the universe. (Read attentively D. W. in A. E., VIII, 45.)

Inasmuch as the bodies of men rest on the earth, and spirits and angels through the limbus rest on men, it follows that angels and spirits rest mediately upon the earth itself as the last foundation. (L. J., 9.) Angels and spirits rest on men *by means of their limbus* because the natural substances composing the limbus are joined with the lowest spiritual substances and are in a sense intermediate between the spiritual and the grosser and palpable organisms of man. The limbus must be kept in form by connection with natural substances coarser and firmer than itself in graded structures even down to earthly solids.

When we say the limbus is composed of the purest substances of nature we mean the purest of the human body; the substances of the natural sun and others proximately emanating therefrom are doubtless prior to these.

On the nature of spiritual substance on the one hand and material on the other, on the intermediate nature of the limbus and its use in giving permanence to the existence of angels and spirits and connecting them with men, we read in *Divine Wisdom*,—

"The angelic mind cannot be procreated, and through procreation multiplied except in man.

"He who knows the quality of substances in the spiritual world, and the quality respectively of matters in the natural world, can easily see that there is no procreation of angelic minds nor can be, except in those and from those who inhabit the ultimate work of creation, the earth. But because the quality of substances in the spiritual world in relation to matters in the natural world is unknown [it shall now be told]. Substances in the spiritual world appear as if material, but they are not; and because they are not material therefore they are not constant. They are correspondences of the affections of the angels and with the affections of the angels they are permanent, and with them they are separated [that is, on the cessation of the affections, the substances composing the object are dispersed, and the object vanishes, see D. L. W., 344; T. C. R., 78]. Similar would it have been with the angels had they been created there. But besides, there is not, nor can be with the angels any procreation and thence multiplication other than a spiritual one, which is that of wisdom and love, such as is also of the souls of men who are generated anew or regenerated. But in the natural world there are matters, by which and from which procreations and afterward formations can take place, thus multiplication of men and thence of angels.

"Spirits and angels hence derive substance and life to eternity."

"The reason is that every angel and spirit from having been first born a man in the world derives substance, for he retains with himself from the inmost [substances] of nature a medium between the spiritual and the natural by which he is finited [that is, definitely terminated and fixed in form] so that he may subsist and be permanent; by this medium he has something related to the things which are in nature and also correspondent to them.

"By this [medium] also spirits and angels can be adjoined and conjoined to the human race, for there is conjunction, and where there is conjunction there must be a medium.

"That there is such a medium the angels know, but because it is from the inmost [substances] of nature and the words and languages are from the ultimates of nature it cannot be described except by abstract [terms]."—D. W. in A. E., VII, 3, 4, 5. (See also D. L. W., 344; L. J., 6-9.)

In *Divine Providence* we read,—“The natural and temporal are the outmosts and ultimates into which man first enters, which he does at birth in order that he may afterwards be introduced into things interior and superior; for outmosts and ultimates are containants, and these are in the natural world. This is why no angel or spirit was created immediately, but why all were first born men and so introduced [into things interior or superior]; hence they have the outmosts and ultimates which in themselves are fixed and established, within which and by which interiors can be held together in connection. But man first puts on the grosser [substances] of nature; his body is from them; but by death he puts them off, and retains the purer [substances] of nature which are nearest to spiritual [substances] and these are his containants. Furthermore in outmosts or ultimates, all things interior or superior are together; wherefore every operation of the LORD is from firsts and ultimates together, thus in fullness. But as the outmosts and ultimates of nature cannot receive the spiritual and eternal things to which the human mind is formed, as these are in themselves, and yet man was born to become spiritual and live forever, therefore man puts off the ultimates and retains only the natural interiors which meet and accord with the spirituals and celestials and subserve them as containants. This is done by the rejection of temporal and natural ultimates, which is the death of the body.”—D. P., 220.

In the above we have the reason of the universal order of creation—the finer in the grosser, the active in the inert, the first in the last, the spiritual in the natural. This difference of substances is necessary, for were there no active, fluid, evanescent substances there would be no life, force, or motion; and were there no solid, inert substances there would be no stability and duration of form.

From the foregoing we see that

because substances in the spiritual world are evanescent and matters in our world are stable and constant, especially in ultimates, the whole spiritual universe acquires organic permanence solely by the natural universe clothing and sustaining it.

And we see that

inasmuch as the human spirit in its rudimental form as an offshoot from the soul of the father is an organism of spiritual

substances evanescent in their nature (D. L. W., 432; T. C. 103; C. L., 220), it must (when begotten) be immediately fixed by taking on the primordial rudimentary form of the material body from the purest elements of nature supplied for the purpose by the mother, thus securing permanence and subsequent growth.

And we further see that

Man does not at death cast off the whole of his material form but only the gross mass and retains the purest part which was nearest his spirit, as a limbus or cutaneous envelope to hold his spirit in endless duration, and as a medium conjoining him with man in the world, thus preserving both; spirits and angels receiving on men and men receiving influx from them. Hence man at death, when he becomes a spirit, is not utterly separated from the material world since he does not reject ALL he has taken from this world but remains (to the extent of his limbus) unconsciously connected with it; all this is to secure the Divine end of creation, an ever-increasing and ever-enduring heaven of human beings.

There is a difference between the states of the limbus of those who die in infancy and of those who die in adult age. In *Heaven and Hell* we read:

"They who die adult have and carry with them a plane acquired from the earthly and material world. This plane is their [external or natural] memory, and its bodily, natural affection. This remains fixed, and is then quiescent; but it still serves their thought after death as an ultimate plane, for the thought flows into it. Hence such as that plane is and such as is the correspondence of the rational with the contents of that plane, such is the man after death. But those who died infants and were educated in heaven have not such a plane, but a spiritual or natural plane; because they derive nothing from the material world and the earthly body they cannot be in so gross affection and hence thoughts; for they derive all from heaven."—H. 345.

We must not infer from the above that those who die in infancy retain no limbus from nature to preserve their spiritual organism. The meaning is they have not a merely natural memory, that is a memory formed in the plane of the limbus, the use of the natural senses as those have who grow up in this life. But while growing in the other life, their memory is formed

in a spiritual structure just within the plane of the spiritual senses and is called spiritual natural because it is in a spiritual plane resting upon the natural. Should their limbus be insufficient for adult stature, it will necessarily be increased as they advance.

As all living organisms undergo change by a resolution and passing off of their substances and renewal by appropriation of new substances, so must it be with the limbus.

We must not suppose that the limbus is taken into the spiritual world. It is natural and must remain in the natural world. Man, as to his spirit being of the spiritual world even from birth and unconsciously an inhabitant there during life in the body, does not go into that world at death but merely awakens to manifest presence there by the opening of his spiritual senses. This is because the spiritual and the natural worlds are not separated by distance but are together and conjoined like soul and body.

How can spirits move from place to place in the spiritual world while clothed with a cutaneous envelope of natural substances? Change of locality in that world is effected by change of state. Swedenborg so travelled there as to his spirit while clothed with the gross body even. (See E. U., 127; H. H., 192, 195.) (Burnham, *loc. cit.*, pp. 53-59.)

In conclusion it must be known

What Man's Beginning Is from Conception

What man's initial or primitive form is in the womb after conception no one can know, because it cannot be seen; moreover it is made of spiritual substance, which is not visible by natural light. Now because there are some in the world who are eager to investigate even the primitive form of man, which is seed from the father, from which conception is effected, and because many of these have fallen into the error of thinking that man is in his fulness from his first, which is the rudiment, and is afterwards perfected by growth, it has been disclosed to me what that rudiment or first is in its form. It has been disclosed to me by angels, to whom it was revealed by the Lord; and because they had made it a part of their wisdom, and it is the enjoyment of their wisdom to communicate to others what they know; permission having been granted, they presented before my eyes in the light of heaven a type of man's initial

form, which was as follows:—There appeared as it were a tiny image of a brain with a delicate delineation of something like a face in front, with no appendage. This primitive in the upper convex part was a structure of contiguous globules or spherules and each spherule was a joining together of those more minute and each of these in like manner of those still more minute. It was thus of three degrees. In front, in the flat part, a kind of delineation appeared for a face. The convex part, which was a type of the brain in least forms, was also divided into two beds as it were, just as the brain in its larger form is divided into two hemispheres. It was told me that the right bed was the receptacle of love, and the left the receptacle of wisdom; and that by wonderful interweavings these were, as it were, consort and partners. It was further shown in the light of heaven, which fell brightly on it, that the structure of this little brain within as to position and movement, was in the order and form of heaven, and that its outer structure was in direct opposition to that order and form. After these things were seen and pointed out, the angels said that the two interior degrees, which were in the order and form of heaven, were the receptacles of love and wisdom from the Lord; and that the exterior degree, which was in direct opposition to the order and form of heaven, was the receptacle of infernal love and insanity; for the reason that man, by hereditary corruption, is born into evils of every kind and these evils reside there in the outermost; and that this corruption cannot be put away, unless the higher degrees are opened, which, as was said, are receptacles of love and wisdom from the Lord. And as love and wisdom are very man, for love and wisdom in their essence are the Lord, and this primitive man is a receptacle, it follows that in that primitive there is continual effort toward the human form which also it gradually assumes. (*Divine Love and Wisdom*, n. 432.)

CHAPTER XVII

SWEDENBORG'S DOCTRINE OF THE GRAND MAN

SWEDENBORG's doctrine of the *Maximus Homo* or *Grand Man*, while founded on his experience of the constitution and ordering of angelic societies in the heavenly world, is capable of illustration in an external way from what we know of society in the natural world, and perhaps such illustration had better precede.

The doctrine that society resembles a larger man in its constitution and functions is at least as old as Plato. It begins to be generally recognized that this conception is something more than analogy, and that there is organic unity in a well-ordered human society. But perhaps it is not so clearly seen that the human form or quality, whether of individual or of collective man, is derived from the one only perfect Man, Who has come to rule as King of Glory in heaven and on earth.

"L'état, c'est moi"—the state, it is myself—these are the words of a despot, and prognosticate delirium in the social brain. If the whole head is sick, the body must suffer. Congestion of blood to the head will be followed by emaciation of the body. Let a priest arrogate to himself supreme power in the church, and, as a consequence, progressive minds are alienated, even if not driven out, because their efforts are antagonized and their usefulness is ended. These organizations are diseased, because they are dissociated from the divine source of life. "If a man abide not in me, he is cast forth as a branch, and is withered; and men gather them, and cast them into the fire, and they are burned." (John XV, 6.)

Societies on earth become alive in proportion as they are connected with interior heavenly societies by truly human organization, and receive a common influx from the Lord through unobstructed channels.

"In the Lord's view the universal human race is as one man in like manner all of one province; and also all of one city and all of one house. It is not the men themselves who thus appear together, but it is the uses with them." (*Divine Love*, VI.) "All who come into heaven are organs or members of the Grand Man." (*Heavenly Arcana*, n. 3631.) "Anyone who wants to live or act his own life cannot be of the Grand Man, but in so far as he desires this he expels himself. Therefore the whole of the Grand Man is a passive force and the Lord alone is the active force." (*Spiritual Diary*, n. 3419.)

I have elsewhere spoken of labor for the common welfare as the life blood of society, uniting many members into a single body. The principle of organic unity is fundamental in sociology. Society is a coöperative association of individuals brought about at first by the compulsion of economic necessity but eventually actuated by the higher principle of brotherly love. The efficiency of society depends on orderly organization, and it possesses the same attributes that come to an individual by training and the practice of virtue.

Plato in *The Republic* (Book 2) speaks of the state as a larger individual in which the same virtues are to be cultivated as in an individual. The different kinds of government possible in the state are also compared with the ruling loves in many classes of men. The highest of mankind are those who love truth above all things and follow wherever it leads. The ideal state is that which is governed by the noblest, wisest, and best among its citizens. This form of government is, Plato, termed an aristocracy, or government by the best; but

it is an aristocracy of intellectual talent, rich in goodness and practical wisdom, and not of blood inheritance. The rulers are chosen by successive selection and elimination of the unfit, and only rule when, after the age of fifty years, they have successfully passed all trials and have won for themselves justly the title of philosopher.

Next below the ideal standard of wisdom is that of honor. It may be founded on false doctrines, and will be apt to be very conservative, but it possesses a certain nobility and courage. The education best suited to develop its traits is that of the soldier. Faithfulness, fortitude, love of power and fame will be leading motives in this character, but not so much, love of truth for its own sake. The state so governed is called by Plato a timocracy.

The third type of character is that of those who worship success. Fortune and favor are their idols. Wisdom and honor are valued as menials conducive to success. The training of a practical business man is the one regarded as of greatest importance in the preparation of a ruler. Utilitarianism and materialism are the leading cults, and oligarchy the name of the state so constituted.

The fourth type is democracy, or government by the majority when the ruling loves are ignoble. License and mediocrity would appear to be the inevitable outcome, either in the individual or the state, when low desires are allowed free choice; and between this and Plato's fifth type, or the tyranny of an autocratic government, or of absolute self-love in the individual, there is only the difference between satanic imbecility and diabolism.

But the question still remains: How far is it possible to regenerate society? Can the ideal of a self-constituted ruler, set up by Professor Simon Newcomb in "His Wisdom, the Defender," where a scientist and inventor obtains supreme

control over powers of nature and thence over mankind, accomplish the release from tyranny? Can socialism guarantee the good behavior or the wisdom of the multitude? Evidently not; yet it seems equally evident that God means us to try to work out our social salvation as of ourselves, but looking to divine revelation for guidance. "Seek and ye shall find, knock,"—or try to apply the truths found by inquiry at the gates of nature and of spirit,—“and it shall be opened unto you.”

Plato's ideal republic was to be governed neither by arbitrarily appointed kings, nor by favorites of the fleeting whims of an unstable populace, but by rulers chosen, with the consent and approval of all the governed, by a system of civil service regulations, supposed to embody the highest attainable wisdom. The scheme implies the rule of truth by common consent and with perfect equality. Its attainment requires a wider knowledge than the world has yet seen.

We need knowledge of facts, or of things as they are; knowledge of forces or of the dynamic principles by means of which things come into existence; knowledge of evolution, or the history of progress, both positive and negative, the sequence of life in its ascent or its degradation; but most of all we need knowledge of spiritual law—of that Heavenly Doctrine which is the source of order, which will bring heaven to earth wherever it is known and applied.

The organic view of society is compared by Mackenzie* to the life of a plant where each “cell may be said to have a life of its own, and in which yet the life of each cell is inseparable from the life of the whole plant. . . . There is, in a sense, neither a whole nor parts. The parts have no independent being; since the relative independence which they enjoy is

* Professor John S. Mackenzie, “An Introduction to Social Philosophy,” second edition, Glasgow, 1895.

merely that independence which belongs to the nature of their system, and not an independence of it. The whole also has no independent being; since it is its nature to exist as a system of relatively independent parts." (*Op. cit.*, p. 145.)

Although partly adopting this organic point of view in treating of social problems, Mackenzie makes some objections to it, chiefly on account of the prevailing tendency to independence, as against organic unity. "The individual is in many ways independent of society, and he may even set himself in opposition to it; and the more perfectly developed a society is, the more does this seem to be the case. It is the prerogative of every man to say 'I'—and to write it with a capital." (*Ibid.*, p. 154.) In the words of Ibsen, (*An Enemy of Society*): "The strongest man on earth is he who stands most entirely alone."

The exception does not seem to me conclusive. The strongest organism will be that having the most vitalized cells. It is one of the penalties of growth to suffer at least temporary estrangement from those who cannot grow so fast. To all such lonely ones the words of Jesus spoken concerning Himself, are applicable: "Ye shall be scattered, every man to his own, and shall leave Me alone; and yet I am not alone, because the Father is with Me." (John XVI, 32.) The highest angels dwell apart (*Heaven and Hell*, n. 189), but this is not from lack of love for their fellows, but because of absence of those whom they can serve. Such isolated but gifted beings look forward with intense longing to a future comradeship with those who can understand them and be one with them; and when opportunity is finally given to such to minister in their chosen office, the love which has been nursed and nourished in secret will flame out all the more powerfully for its previous repression. There are organs in the human body of the highest utility, which remain unused until their appointed time. There are states of society whose preparation has long

been going forward. There are remnants of life from the childhood of the race which have a place apart where they are nourished for a season in secrecy until the time of their showing.

Read William Morris' "House of the Wolfings," and see if there was not among those Germanic communal associations something that we have lost, something for which we yearn that is too good to perish forever, something which will surely be given back to us again, when we are worthy to receive it.

Professor Mackenzie is more satisfactory in his consideration of the essentials of organization which are involved in his three questions: "(1) Are the parts of a society intrinsically related to the whole of which they are parts? (2) Does society grow from within? (3) Has society a reference to an inner end?" (p. 166.)

The reply to the first question is, that every nation has its own type of character; that the strongest souls are most affected by the "spirit of the times," or by what Emerson calls the "world-soul"; that we are indebted to our ancestry for much of our character, and in knowledge stand upon the shoulders of our predecessors; that language, the very means of expressing and forming thought, is an inheritance.

Again the social life is continually changing by vital accretions. Constitutions do not make the people, but the people their constitutions. Language, social custom, national character, develop by absorption of individual characteristics into the larger life of the general body. Thus society in a state of freedom, where alone there is growth, always grows from within. We, as individuals, are making the society of the future. Every word and act of ours reacts on our neighbors and modifies the general life.

Finally, "in changing our modes of thought and speech, and the customs and institutions of our social life, we are trying

to make our life in some respects more possible or more happy. . . . If anything else is ever proposed as an end—such as the realization of a divine purpose in the world—we at least think of this other end as one in which the well-being of persons is an indispensable part.” (*Ibid.*, p. 176.) Thus society does conform to the essential features of a growing organism.

Paul’s parable of the body and the members (I Corinthians, XII) dwells upon analogies; and Plato’s comparisons are not pushed to final completeness; but Swedenborg’s declarations concerning the Grand Man and the organization of the heavenly societies are the first fulfilment of the requisites of a logical and scientific treatment of the doctrine of the human form, considered as an orderly organic connection of parts for the performance of uses. We have here a rational theory of organization as exhibited in various degrees of being. The conception is the most powerfully unifying one that can be given. Its universality is absolute.

The doctrines of heaven are all susceptible of confirmation from the things of earth, and especially from those human affairs which are the highest earthly attributes. It is therefore a matter for congratulation that we begin to have a scientific doctrine of society as a human organism.

THE INTERNAL LIFE OF SOCIETY

[At the beginning of the century, a remarkable paper was published by M. R. de la Grasserie in the French journal *L’Humanité Nouvelle*, concerning the classification of social phenomena. (Librairie C. Reinwald. Schleicher frères, Editeurs. 15 Rue des Saintes-Pères, Paris, No. 42, Dec., 1900, pp. 717-734; No. 43, Jan., 1901, pp. 26-37.) The general conception of a classification of social functions, based upon their similarity to the physiological activities of the human body, will not be new to those who are familiar with Sweden-

borg's doctrine of the Grand Man; but as this scientific analysis brings independent testimony to the strength and cogency of this line of argument, it ought to be welcomed by those who accept the idea that society is an organism, and who seek from physiological analogies suggestions in regard to an improved social order.

In describing this "Classification of Social Phenomena," I shall follow the original closely, sometimes quoting the author's language (in translated form), and distinguishing any additions or interpolations of my own, for which this author possibly might not wish to stand sponsor, by including them in square brackets wherever there might be doubt in regard to authorship."

The internal life of society may be defined as that of its vital functions, corresponding to nutrition, cell-multiplication, and muscular activity; or, in general, to the physiology of all those tissues and organs of the body which are not made up distinctively of nerve-elements. The *central* life of society represents that of the brain and its prolongations—the nerves.

Society exists in potency in a single married pair; but before this potency becomes actual there must be a sufficient multiplication of individuals to permit the division of labor, by which alone the benefits of organization are obtained.

That which is reproduction for the individual becomes nutrition [that is to say, growth of tissue] for society. Such is *internal* reproduction. This internal reproduction takes place in the same sense for the human body. We know that each cell is destroyed and replaced by another formed by the somatic elements. Thus an interior generation is not that of a man producing another man, but of a human cell producing another cell. For the cell it is a generation, but for the man it is only nutrition. However, without this generation the man would perish, and, perishing, he could not in his turn propagate by a total and external generation. In the same way society lives by the incessant reproduction of the social elements, a reproduction which

has for its end the perpetuation of the species, and consequently of society. The latter in its turn propagates, but in an entirely different way: A nation is too numerous for its restricted territory. It gets rid of its surplus population by colonization. The colony prospers. It remains for some time attached to the mother country. Then it separates itself from it, either pacifically or violently, and forms a new society. A collective society has given birth to another collective society which is different from it. It is the same with a man: After the generation of one cell by another, there is reproduced the whole. Thus there are two sorts of phenomena of reproduction, the one internal, the other external.

Social relations between the men of one society are external; but the central action of society on its members, while a phenomenon of relation, is comparable to that of the nervous system in the human body.

Besides the quantitative and qualitative distinctions common to all classifications, internal social phenomena must be divided into normal and abnormal, analogous to those activities in the body which are grouped under physiology and pathology. These must be examined apart from any coercion exercised by society, for the latter belongs to the centralization of the social brain. And finally there are evidences of survival, or atavism, which this author classifies under social embryology, but which, if persistent, may belong to those conserving agencies which give form to society, as the bones give shape to the body, or as the inorganic atomic substratum gives permanence to those organic substances by which vital activities are continued.

Science to be exact must be quantitative. M. de la Grasserie explains that in order to place sociology on a scientific basis and to prevent sporadic occurrences from being mistaken for those which are habitual, there must be social statistics. Social phenomena are influenced by the environment, which includes the historic epoch, physiographic sur-

roundings, and ethnic inheritance; in general, both material and intellectual factors.

Society is an organism superior to the individual. Sociology rests upon psychology, as this upon biology; and in turn philosophy, which deals with universals and includes supernatural or extramundane factors, must have its cosmological side.

History, again, is comparatively like the current record of the weather. Sociology is rather like chemistry and physics, dealing with the underlying principles which control the weather.

Historic social phenomena which are concordant must be separated from those of a different kind which would obscure the guiding principles, in order to educe a classification which will give the sociological laws of social phenomena.

These relations are now to be examined more in detail, to see if the general resemblances continue to hold good when the leading principles are carried to legitimate conclusions in regard to minor inclusions. For purposes of reference, and to serve as a connecting or guiding thread, a lettered classification is added.

(A) *Normal Internal Phenomena of Society*

These include, (Aa) phenomena of social internal nutrition, (Ab) internal reproduction, (Ac) connectives, and (Ad) motive powers.

(Aa) "While for the individual man the operations of nutrition consist in taking nourishment, digesting it, transforming it into liquid blood, and by this liquid nourishing the tissues, finally in rejecting unassimilated tissues in divers ways, whence come the operations of digestion, secretion, and circulation—in like manner those of internal social nutrition constitute the end of economic study. They are divided into phenomena of production, circulation, distribution, and con-

sumption. This classical division is very exact. These are all economic phenomena."

Production is carried on by agriculture, the fisheries, mining, manufacturing, etc. Circulation employs "roads, public conveyances, boats, railways, telegraphs, and telephones, bills of exchange and commerce. It has been compared very justly to the passing of the blood from one end of the human organism to the other."

"Distribution is made by means of wholesale and retail trade, by which the objects procured and transported are then divided for presentation to the consumers, according to their needs. It is similar to the distribution of the blood in the tissues to be absorbed by them" [and is governed by the law of supply and demand].

"Consumption consists in the absorption of the different products—food or others which agriculture or industry has created, and which commerce has delivered. It is equivalent to the absorption of the blood by the tissues."

"Finally, the objects thus absorbed cannot all be assimilated, and, on the other hand, even if they have been imbibed for a time, they are eventually thrown off. It is necessary to include among the products of dis-assimilation, or of non-assimilation, analogous to biologic excretions and secretions, entire classes—those of mendicants, vagabonds, prostitutes—outclassed by their own fault or by that of society."

[There are also special classes in society fulfilling the excretory office. "Those who constitute the province of the kidneys, the ureters, and the bladder, in the Grand Man, are of such a genius and temper that they desire nothing more intently than to explore and scrutinize the quality of others, and some of them also desire to chastise and punish, provided there be anything of justice in the case." (*Heavenly Arcana*, n. 381.)]

Thus within the internal society, that is, between the human molecules which compose it, there take place phenomena analogous to digestion, circulation, and excretion in the biological body. They constitute economics.

In considering the fundamental needs of society, economic questions must take precedence, not because there is any doubt of their inferior rank, but because "they belong to the substructure of society." Higher developments are impossible and insecure if the foundation is unstable. *Mens sana in corpore sano* applies to society as much as to the individual. [In New Church philosophy, all progress is recognized to be from above. It is the utility of the lower offices for serving higher ends that ennoble the lower uses; and the zeal of many unselfish socialistic workers who know nothing of spiritual truth, may flow interiorly from the angelic love of use descending from the new heavens. The religion of humanity, or of equal justice for all, is not to be despised, even if it sometimes fails to honor the name of the Lord. Love of the neighbor must precede celestial love. Leigh Hunt's beautiful version of "Abou ben Adhem" emphasizes the vital union of some nominal distinctions.]

(Ab) Internal social reproduction includes not only the multiplication of individuals, analogous to cell-growth, but also their development, which, socially, constitutes education and resembles the embryogeny of the individual human being or the histogeny of the cell.

The increase of population is of fundamental importance for society. Without such increase the nation becomes weak and may be conquered by some stronger nation. "That half of the families in a state may be fertile and the other half childless does not concern the state, provided it obtains an average fecundity." [Unless the fertile half includes the most desirable members of the community, while the nobler el-

ments die out, leaving no issue; nevertheless the wisdom of laws which permit any divergence in the interests of the family and the state is open to question. The increase of the family is not an unmixed blessing to the individual. In spite of the satisfactions of family life, its extra burdens deter many from marrying. It has frequently been urged that society should offer special inducements, or rewards, to encourage family growth; and the suggestion is worthy of the careful consideration of legislators.]

Some societies, for example, the United States and the Argentine Republic, have grown largely by immigration. "The fusion of newcomers with the old inhabitants procures an immediate population without waiting for the effect of time, but a heterogeneous one and having a less vigorous national spirit. Here again internal social reproduction resembles reproduction in the individual." [Adopted children are assimilated into the family with difficulty. From lack of inherited ability, such children are apt to take little interest in the family life and are often lackadaisical.]

"Finally, the mixture of races and the production of half-breed or mongrel peoples is not without analogy among individual misalliances." [The deterioration of races is sometimes attributable to this cause, and may go so far that correspondence of function to its own spiritual organ in the Grand Man ceases, so that some other nation enters into the spiritual inheritance of such a people.]

[The education of every child born under its jurisdiction concerns the state. The efficiency of its citizens depends upon their training, and society cannot afford to support a large number of useless supernumeraries. Not only must individuals be developed physically, intellectually, morally, and industrially, a process similar to the histogeny of the cell, but the entire people must be continually educated to higher levels,

and be assigned to new tasks, and prepared for larger opportunities. This constitutes the embryogeny of the race.] "It is not enough that the descendant exists in germ. It is necessary that the child shall go through all the phases of intra-uterine life, as a fruit needs to ripen. Hence in internal social reproduction it is important that the men making part of a society become adult [and efficient], for otherwise they are an expense to society and not a profit. The individual man must be not only conceived but born. Much more must the social man be developed beyond an infantile state."

(Ac) Of the internal social bonds, community of language is most powerful, and it is essential to nationality. M. de Grasserie says: "Language is the special phenomenon of the life of social relation between individuals. It is in sociological manners what hearing, sight, smell are in biologic matters."

[There is a more interior language, that of perception (corresponding more especially to the sense of smell), by which, for example, an artist appeals to men of every race; but the common perception which draws all minds together is intimately related to a higher connective of nerve-tissue which serves the central impressional life. The nerve-tissue is indeed a connective which permeates the body everywhere to such a degree that, if it were exhibited apart from all other tissues, could not be distinguished in form from the complete body.]

[Physiographic causes which determine employments, and the influence of climate (for which see the first volume of Dr. J. W. Draper's "History of the American Civil War" and his speculations on the effect which physiologic peculiarities of local populations, determined by climate, have upon the course of history) together with the unifying action exerted by improved facilities for communication in space, the press, and those social functions which tend to mould public opinion and keep the people *in touch* with each other, are related to those

organs of touch in the body which are especially needed for its connected action and preservation, and which appertain to the common connective skin. Besides aiding in the coördination of movements which are internal, the senses also keep us in communication with the outside world, and therefore must have a dual classification, being equally important in external social relations.]

[(Ad) Internal social *motive* powers are related to the muscular system. The muscles are embodied forces. The forces which can move society to prolonged effort, involving the activity of all classes, are spiritual affections. Religion, morality, patriotism, love of use are the deepest sources of power. Statesmen cannot create but can only guide these forces. The army and the navy, trades-unions, trusts, and all other organizations within society for obtaining and exerting power by combined action, are like the arms and legs of a man. They are powerful levers for advancing the interests of society, whether exerted for good ends, or when concentrated for evil purposes. They draw their power from deeper underlying forces—love of use or of gain, love of country, love of dominion for the sake of self, from the noblest and the basest of motives—but their own special prerogative is *simultaneous action* by common consent. In this consentaneous action is exhibited the power of the nation, as shown in the quickening of the national life for defence in a time of threatened calamity.]

(B) *Abnormal Phenomena within Society*

(Ba) *Social pathology*. "The principal social sickness is perhaps crime, or, more exactly, the existence of the criminal who is the object of criminology, not when he has been struck by a condemnation, for in this case society has intervened, and it is then a question sometimes of the action of central society;

but when he exists as a germ, either for a first crime or for subsequent crimes. This existence, if there are many criminals, is a veritable disease for the criminal himself, if we follow the determinist systems, and at any rate for society as a whole. The sickness may become very serious, if the criminals are numerous or hardened, for example in the case of a second offense. Criminology begins to be studied with reason from the pathologic point of view. With the criminals are connected, by more than one bond of union, the insane."

[Evils and falsities are spiritual diseases, and they induce natural sickness. "Diseases have no correspondence with heaven, which is the Grand Man, but with those who are in hells. The reason diseases have correspondence with them is, that diseases correspond to the cupidities and passions of the disposition; these too, are their origin; for, in general, the origins of diseases are intemperances, luxuries of various kinds, merely corporeal pleasures, and also envies, hatreds, revenges, lasciviousnesses, and the like, which destroy the interiors of man, on the destruction of which the exteriors suffer, and draw the man into disease, and thus into death." (*Heavenly Arcana*, n. 5712.)]

[There is no sickness in heaven, and an orderly form of society should have no social diseases. A corrupt society sins against its members. Unjust laws and immoral practices of the ruling classes bring a terrible punishment upon society in harvests of crime. Want, resulting from unjust inequality in the distribution of the rewards of labor, is a serious social disease. There is an analogy here to congestion or fever. Repletion and wastefulness in one part of the community cannot compensate for poverty and distress in another part. It is orderly structure, and not mere bulk, that counts in an organism. Ill-gotten gains, accompanied by huge popular discontent, do not constitute a source of national strength, but

point to a dangerous crisis. All of the phenomena of production and distribution are so intimately connected that they require a common control. It is a crime when the market, which is the heart of society, is controlled by a clique of gamblers.]

[Prostitution, sometimes called *the* social evil, although obviously only one of many social diseases, is passed over rather lightly in M. de la Grasserie's treatise. It is a sore spot for Frenchmen, among whom laxity of morals in a variety of forms has probably been the chief cause of the decrease in the birth rate. Since in our own land the crime against the unborn is all too prevalent, and race-suicide, or the extinction of certain families, usually among the more intelligent classes, is not unknown, which must, in the end, bring social emaciation and degradation, the lesson to be drawn from the situation in France should not be allowed to pass unnoticed. The growing evil of divorce and remarriage, in direct repudiation of the words of Jesus: "Whosoever shall put away his wife and marry another, committeth adultery against her. And if a woman shall put away her husband, and be married to another, she committeth adultery," (Mark X, 11, 12), threatens an adulterous blight on coming generations. The paper, "Marriage and Its Ruin," by Asa E. Goddard, in the *New-Church Review* for July, 1923, shows how acute and how widespread is this danger to society.]

(Bb) *Social Monstrosities*. Besides the confirmed criminals and the incurably insane, [there are in many lands ascetic orders which condemn a life of usefulness, and which, by practices leading to self-indulgence, become a burden to the community. The class may also include those whose teachings are a moral pestilence, perverting the highest interests of society, but against whom all penal codes are powerless. Those who seek to take away the belief in God are spiritual murderers.

(T. C. R., n. 310. See *ante*.) Those who try to overthrow the sanctity of marriage, or the belief in a future life or in the Divinity of the Word, are doing deeds which are monstrous, and in spiritual light they appear as monsters. (See *Heavenly Arcana*, n. 5199.)]

(Bc) *Social Therapeutics*. [History tells us that nations, like individuals, may die, probably in every case from deep-seated evils which pervert the moral and religious life. Such societies are rotten at the core. There is urgent need, therefore, of social medicine.] The penitentiary, and the study of "prison-discipline, or the science of the reforming action of punishment" are invoked for this purpose. When distress becomes magnified to a social calamity,—“for example, in case of epidemics, conflagrations, famine, etc.,—society grants aid in its collective capacity. It must, besides, give regularly the special therapeutics of want.” [Departments of public charity are, however, palliatives rather than cures, and preventive measures are far more important.]

(Bd) *Social Hygiene*. Workhouses for vagrants, the indolent, and chronic drunkards, and asylums for the violently insane, while in a measure therapeutic agencies for the lesser evils, are adopted by society to prevent the greater evils of terrible crime at the hands of the partially irresponsible wards of the state; and these institutions, also temperance societies and rewards for virtuous actions, belong to the department of preventive social medicine, or hygiene. [The multiplication of social hygienic agencies, of societies for the reform of every unhealthy public policy which breeds injustice or social congestion, leading to misery and discontent, if not to crime; the establishment of societies for giving innocent recreation to the young, free courses of public instruction, the opening of museums, art collections, and libraries, and above all, the church in the large sense of all organized effort for cultivating

the spiritual life,—these are the most promising means at work today to improve the social health.]

(Be) *Social Atavism.* In the animal economy, we find many curious instances of the reappearance or survival of functions which have very little use. They come under the head of atavism. There are similar social survivals.—“Vagrancy, for instance, is a very singular phenomenon. It rests upon the persistent taste for savage life among the civilized. The tramp is everywhere tracked, and even put in prison, which ought to diminish his apathy somewhat. Nevertheless, he persists, not from pure laziness, but from innate disposition.”—He may be regarded as a survival of the nomadic life of former times. The tendency seems to be ineradicable in the Gypsies and Bohemians.

“Another connected phenomenon is mendicancy, yet one quite distinct. Formerly it was honored. The great were surrounded by mendicants who were their parasites. Prayer itself [at least if it is for objects which we can and ought to provide by our own efforts, may easily become] a disguised mendicancy transported to the spiritual world, [where, however, such prayer cannot enter.] In fact, there were in the middle ages numerous religious orders of mendicants. The troubadours practiced a literary mendicancy.” [It is often a puzzling question whether subsidies and pensions granted by the state to encourage independent or honorable, but unremunerative action may not, by an easy transition, degenerate into a kind of parasitism. Nothing but a magnificent self-control, and a method and purpose back of his rejection of the conventions of society, could have prevented Thoreau’s plea for a simpler mode of living, nearer to nature, from degenerating into mere vagrancy. The line between genius and madness is often very narrow. It behooves us to be slow to dub a new movement “an atavic retrogression”; it may turn out to be a glorious new departure. The tree must be judged by its fruit.]

There are some cases of atavic retrogression in regard to which there can be no doubt. Traffic in offices was customary and a source of revenue to the highest dignitaries in feudal times. Bribery, under the ban of law, is its disgraceful survival.

The duel is the survival of an ancient ordeal, once supposed to be a divinely appointed test of justice, the heavenly powers giving victory to the right. Lynch law and the vendetta survive or reappear, as do atavic characteristics among animals, even in highly civilized countries like our own, where the burning to death of a human being at the stake by a mob brings a shock from its obvious anachronism with societies for the protection of abused kittens.

"Social phenomena of survival and atavism are the cause of great historic disorders. When a function can no longer be fulfilled by an organ, it is important that this organ should disappear. Thus aristocracy of the blood, after having had a logical existence as long as nations have been obliged to defend themselves by military means, becomes illogical when mercantilism succeeds militarism; and if a moneyed aristocracy after having been useful in its turn, has become noxious, it is because it is already nothing but a survival."

[The new wine of the new age requires new bottles for its preservation. At every great epoch of change, there is an increased activity, a stronger influx of life producing variation in larger measure—in a word evolution proceeds with more rapid strides. There must be room for growth, and society, for its own preservation, must so legislate that there shall be no repression of any element of social life on whose development the salvation of society itself may depend.]

(C) *The Central Life of Society*

It is common for one charged with the direction of affairs to be called "the head" of a movement or business. In the greater social order this function is more complex. The cen-

tral life of society falls into a threefold order: learning, art, politics.

The brain is the most complex organ of the body, and in like manner the social brain embraces a multitude of human activities the interaction of which and proportional efficacy in promoting the general movement of society might be as difficult to follow as the unraveling of some complicated plexus of nerve fibers. No single individual can possibly fulfil this supreme function. The theory of the divine right or superior wisdom of kings breaks down in confusion before the herculean task of even apprehending the multiplicity of forces which direct society.

The beginnings of the brain are in least cortical forms, of which multitudes come into play in controlling even comparatively simple bodily actions, while the more complex activities, which involve whole tracts of the body, must employ assorted groups of these least brains, in coördinated classes, with distinct but mutually connected functions to perform.

All of the bodily activities originate in the initiative of the brain, which thus becomes the "center" in the sense of being at the beginning of all life on the physical plane. Indeed this supremacy is of even deeper import, since the influx of soul life into the body requires the copartnership of these same cortical glands of the brain.

Most of the individuals constituting society are like cells or "social molecules composing it and accomplishing the functions of nutrition, reproduction, and internal connection." They drift with every passing wind of sentiment, change face with every new administration, take the color of every new popular movement, live mainly to eat, drink, sleep, and reproduce their kind, but are powerless to originate anything, and can only be led. This is a vegetative sort of existence. A man is truly human by reason of intellect. M. de la Grasserie says:

"Just as man exists veritably only when the brain has bound together and coördinated the different parts, in the same way [is society vitalized when] cerebral society is constituted."

In continuing the presentation of M. de la Grasserie's analysis of social phenomena, the subject of the central life of society (C), or that of government, corresponding to the cerebro-spinal bodily activities, falls into three divisions: (Ca) Social central intelligence—the social brain—statesmen, thinkers, scientists, philosophers. (Cb) Social sensation, or rather the spontaneous affectional life of the people which requires the sense-life for its exercise and is embodied in art, literature, music. (Cc) The social will in action—jurisprudence, politics, the enforcement of the laws, administration. "The first of these divisions has an extreme importance for central and synthetic existence." The phenomena of central social intelligence are "eminently directive." They control all others as doctrines order the intellectual life of an individual.

"The sensorium of the unit of human personality is the brain directing the members by the nervous network which terminates in them and goes from them, and, considering the whole, it is what governs and exercises these higher functions [of personality]. It is this which in person or by its subordinates can enter into relations with other men. It is the aristocratic and even the monarchical part of the human body."

"In the same way, society possesses a sensorium or social brain, composed of the choice of the individuals who regulate the others and give impulse to the masses. It is thus that society is moved, wills, and thinks, as a whole. All the rest—nutrition, reproduction, connection—were only preparatory. This sensorium is composed not only of our governments, as some have thought, but of all those who are raised to a higher degree by their education or intelligence, and who, if they do not govern in fact, *could* govern [if they were called upon to do

so]. These are all men capable of occupying themselves with higher thoughts or of enlightening others. [Moreover, such minds do have a part in government of society, even if not in office; for just as the action of a comparatively simple nerve-impulse may involve the previous activity of a complex network of nerve-fibers in some plexus of the brain, so public opinion, to which the rulers of a republic must bow in the end, is moulded by the thought of many minds, and the heavenly powers are not without their vicegerents in the affairs of men through motions of the hidden springs of action among the wise-hearted.]”

[This author’s conception of the subject matter of social intellection is of little value, since he is not aware that there are different degrees of truth; but his “synthetic science,” which is to be the crown, if it were to be at all complete, would be no other than that perfect philosophy which traces the connection between Truth Divine and its outermost embodiment in the facts with which natural science deals.]

“The sensorium of society,” says M. de la Grasserie, “will be formed from the point of view of the intellect of all those who know. The thinkers constitute the sole veritable aristocracy. They are the stars which enlighten, just as the men of action contribute the necessary innervation, and the artists the impressions.”

(Cb) “If science belongs to the intellect, art concerns the impressional life, and it is necessary to comprise within it, in the broadest sense, not only architecture, painting, sculpture, music, and the other arts properly so called, but also poetry and literature. We must even join to these the industrial arts, when they are not an application of science, but a substratum of the fine arts or one of their industrial applications. We see that the field is very extensive.

[History has nearly always placed an undue weight upon

politics and the doings of armies; but whenever history tries to discover the causes of men's actions, it becomes apparent that the real character of a people is best exhibited by its arts and sciences. Literature and language are mutually creative. From remnants of ancient speech, the mode of life and religious beliefs of forgotten peoples have been partially recovered. It is seen that religion is the root from which have sprung both ancient art and science. In thoroughly homogeneous and long-established nations a national architecture, poetry, or music is found, reflecting the psychical life of the race and the spirit of the times as no other mode of expression can; and, conversely, these agencies help to form the peculiar life of the people.] "By the style in favor in the arts taken together, we may judge of the period of civilization attained by a nation, and even distinguish them as hunters, shepherds, or laborers. We distinguish also national stages of architecture, sculpture, or painting. Literature itself is first lapidary, before descending to parchment."

(Cc) The phenomena of volition are socially those which most intimately affect individual rights. Society turns to each of its members and imposes its will upon them. These phenomena form several groups: (1) The juridical phenomena which appear in the regulation of the relations between the members of society, whether these relations are civil or commercial or of the penal deprivation of rights. (2) The political phenomena which regulate the relations of each citizen toward the whole, whether these relations are simply administrative or constitutional or political; but it is an error to include moral life which is not social but purely psychologic, although the standard of right may be founded on manners or customs. (3) Penal phenomena, where the citizens are punished who commit a breach of order which may endanger or injure society, the others retaining their rights.

[It is true that many of the institutions now existing for the avowed purpose of righting the affairs of men are sadly in need of being themselves set right.]

We cannot trust ourselves to behave with decency; we cannot trust our consciences; and the remedy proposed is to elect a round number of our neighbors pretty much at random, and say to these: Be ye our conscience; make laws so wise, and continue from year to year to administer them so wisely, that they shall save us from ourselves and make us righteous and happy, world without end. Amen! (R. L. Stevenson, "The Day After Tomorrow.")

Juridical phenomena include those of jurisprudence—or the fundamental principles of law—and judicial affairs relating to the administration of the statutes. These and penal judgments, whether they affect individuals or corporations or states, derive their social significance from the fact that they are public adjustments of disputed questions of fact or behavior, which have been taken out of individual control because the well-being of society demands their treatment along lines of uniform procedure and settled polity.

Laws, in turn, while entrusted to the administration and interpretation of judges learned in jurisprudence, are continually being modified by legislation under political control, and this again, if the principles of eternal justice are to be, in however feeble a degree, dimly imagined, must be guided by the last resort of finite intelligences—the wisdom of those gifted ones who are able to walk alone with truth.

Reason, founded on truth, is the only ruler whom freemen can willingly obey. Thus the impersonal truth is above princes, as man—the spiritual being—is superior to the most perfect mechanism of brain and brawn.

Societies as well as individuals should be guided in their actions by moral principles, but these cannot be made to order by authorized ecclesiastical regulators. The church as a sub-

ordinate institution, belonging to and regulated by the state, ceases to uplift the souls of men and is itself degraded. "My kingdom is not of this world," says the only legitimate supreme ruler, the Divine Truth.

National Life

As soon as individualism begins to give way to recognition of the higher claims of society, and care for the public welfare takes precedence over selfish interests, an impetus has been given to the organization of society, whose final outcome is national life.

Before there can be a national existence, there must be public spirit, the knowledge and love of a common good toward which all hearts turn—a common rallying cry which can move the entire people to united action. There must be some ruling love of good to give life to the nation, or else there will enter the interior love of evil, dragging the nation down to spiritual death. If the ruling love favors law, order, the securing of family ties, mutual helpfulness, and progressive industry, happy is that nation; but if cruelty, license to do evil, the spirit of caste, rapacity and self-seeking hold sway, that nation is a form of evil—a monstrosity. Perhaps nowhere at the present time is there an example of the perfect community, unless there may be the beginning of such a society, unknown to fame, and guarded by the Lord in some remote corner of the Earth. Neither can any of the leading nations be called wholly evil; but tendency to extremes—great good and huge evil existing side by side—often excites the question, How can these things be? For its answer we must turn to the Lord's parable of the tares and the wheat.

Since the love and worship of a people determine the quality of national life, this love or this interior good, is the nation in the deepest sense. Until imbued with such love, there may

be a great gathering of people—many men of many minds—but no nation. A great multitude of people does not constitute a nation. A horde of nomads has hardly emerged from barbarism. To be a nation means the capacity of a people to act as a unit and to enter into external relations with other nations. National life is both internal and external, but its special indication is the ability to act outside of itself. This ability presupposes an orderly internal organization and life, from which the external acts may flow, but it is the external life of society that constitutes peculiarly the national activity.

Nations signify the goods and the evils in worship. The case, further, is this: In the most ancient times [men] dwelt distinguished into nations, families, and houses, for the reason that the church on earth might represent the Lord's kingdom, where all are distinguished into societies, and the societies into greater ones, and this according to the differences of love and faith in general and in special; thus in like manner as it were into houses, families, and nations. From this, "houses," "families" and "nations" in the Word signify the goods of love and of the derivative faith; and a distinction is there accurately made between "nations" and "people." By a "nation" is signified good or evil; but by a "people" truth or falsity, and this so constantly that it is never otherwise. (*Heavenly Arcana*, n. 1259.)

As the term "nation" is used with a deeper signification than "the people" in the Holy Word, in like manner the external life of the nation which is its peculiar characteristic is given the highest place by publicists. It is conceded that the State Department of our Government takes precedence over others. Only the wisest statesmen are fitted to guide the external policies of a nation.

In the series constituted by the inter-relation of cells producing the bodily activities, and of motives and thoughts which make the spiritual man, the conjunction of individuals to form societies and nations, and the intercourse of nations which makes the world, there are repetitions of similar processes on

successive planes. Thoughts have their ancestry and relations. Societies, as we have seen, are nourished by the performance of those uses which require corporate or consociate action, grow by reception of new individuals, and are developed by their education. Nations grow at first by spreading over new territory; but as this process has its limits, national growth must eventually consist in a more highly perfected achievement of results dependent upon internal development.

In the classification of M. de la Grasserie, the external life of society is regarded as entirely similar to its internal life, and is treated under the same heads. We may grant that the external acts of a man flow from his character and exhibit his quality as to ability, training, and moral excellence. There is, however, a discrete degree between cause and act, and something remains to be said after the more obvious resemblances between inner states and outer acts have been exhausted. Indeed, the subject, as approached in this way, has something of artificiality, or at least of superficiality, while the more vital connections between the inner life and its outward exponent activity are real.

By analogy with the principles of classification enunciated in the preceding sections, national life may be considered under three heads: (D) *Normal external social phenomena*, or the procuring of means for national progression and development. (E) *Abnormal external social phenomena*. (F) *Federal phenomena*—the ideal “parliament of nations,” corresponding to a reformed humanity when the demands of the higher law are obeyed; which was attempted in President Wilson's League of Nations.

These, again, may be divided in nearly the same way as the former heads: (Da) *National nutrition*: Exploitation of colonies, international commerce, conquest. (Db) *National reproduction*: The foundation of new states by colonization,

by secession, or by fusion of neighboring states. (Dc) *National connective phenomena*: Wars, treaties, alliances; but (Dd) *The power of the nations* is of the Divine Providence, and according to the national love of good.

(D) *Normal External Life of Society*

In heaven . . . spheres proceed from every society and from every angel. These spheres exhale from the life of each one's affections of good and truth, and pour themselves out thence to a distance. . . . The angels and societies are conjoined and also disjoined, according to these spheres. (*Heavenly Arcana*, n. 9606.)

Everyone exerts an influence on society by the uses he performs. The combined or organized efforts of individuals make up the proceeding sphere of a society, which has a quality of its own depending upon the form and order of the organization. The sonorous vibrations of material substances are mutually destructive, or produce mere noise and clatter, unless ordered by the hand of the musician. Organized into orchestration, these concussions and pulsations produce a proceeding sphere of musical harmony. Thus ought the life of society to proceed as a breath of order, animating every part of the community.

(Da) Before a nation can engage actively in special external uses, it must strengthen itself. Its first acts are therefore nutritive. Exploring expeditions are sent out to discover new lands which may be added to the public domain. This does not differ in principle from the use performed by geologic surveys in discovering and developing the mineral resources of a country, for until these sources of revenue are made known, they are as far from realization as though in a foreign land. The nation may enlarge its domain by occupying new territory, obtained either peaceably by right of discovery, or by purchase, or rapaciously by conquest. It may also enlarge

its resources by developing those previously unrecognized or in abeyance.

Some of the most important public applications of science. The Coast Survey; Lighthouse Boards; the work of the Hydrographic Office, including the making and publication of ocean charts; the exploration of the depths of the sea; the laying and working of submarine cables; in our own day, wireless telegraphy, the development of the laws of storms; the maintenance of national observatories, and the publication of nautical almanacs; the invention of a great variety of contrivances for the perfection of steamships, etc.—are for the benefit of international commerce, which is a potent feature of national nutrition.

Colonies, when these are regarded as sources of revenue, rather than as incipient nations, contribute to national alimentation. In this case "there is no political possession of the soil, but merely the establishment of commercial controls or factory systems to which the natives must deliver their products. Sometimes, to facilitate this mode of procedure, protectorates are established." [The administration of the affairs of an inferior race by a people of higher civilization may sometimes be mutually beneficial. The Dutch rule in Java is often held to be of this nature; but it is seldom that the servitor nation is regarded as other than a lawful prey.]

"Colonization," says M. de la Grasserie, resembles the digestive biologic function, which is sub-divided into the imbibing of nourishment, mastication, deglutation, etc. It is an absorption of foreign products.

Circulation consists here in opening ways of communication which permit distribution of aliments gathered without, and often from afar, to different parts of the social body. It is realized by the making of internal ports, of river navigation, of networks of international railways, and by maritime navigation.

International commerce contributes also to nutrition in its digestive part [as well as by its circulatory office], for it brings food from without to the entire nation and produces capital. It is not less active than colonization, but employs a different means. The most remarkable factor, and that which contributes most to social nutrition, is maritime commerce, which, for that matter, is intimately connected with colonization. One would be tempted to see in this a phenomenon of circulation if the latter did not follow digestion. [It does not seem necessary, however, to insist upon this circumstance of sequence. Functions which are successive in the body may be simultaneous in society. It is the absolute necessity of the existence and connection of these functions to the well-being of society, rather than their sequence, which is significant in the comparison of society to a living being; and there *is* something analogous to this simultaneous carrying on of diverse functions in the animal organism, since the white blood corpuscles receive nourishment and grow, or undergo changes, while being carried along in the current of the circulation—indeed, one may say that the blood is born in transit; for its globules become enucleated, as its truly living and most highly organized centers, contributed by the brain-substance itself (we have seen how important a part social cerebral life plays in commerce), are furnished with bodies of a grosser sort derived from the substances assimilated by the lacteals of the intestines, while the milky product of the first act of digestion is being mingled with the red blood, and thus the newcomers are adopted into the great family.]

Conquest is a more energetic mode of nutrition of external society, especially if the conquered nation becomes tributary. "Then one nation may be said to devour another, or may live parasitically upon it, subsisting in idleness or giving itself up only to the exercise of arms. It is the same with still greater reason, in the case of slavery. The free citizen works only by his slaves, and all his outward activity consists in procuring more slaves. Slavery is a veritable [although an iniquitous] means of nutrition of external society.

Finally, dissimilation consists in the separation of products which cannot be absorbed. For example, conquests sometimes incorporate something of durable life into the country. Their acquisition constitutes a function of nutrition. But sometimes

there can be no more assimilation than for a hard or indigestible substance which has been introduced into the stomach. Such ingestion far from being useful, becomes annoying and may cause colic. Expulsion is inevitable. Thus inopportune conquest leads to secession sooner or later. [In spite of imperial pills for aiding digestion.] Secession is the inverse of annexation and conquest. It is accomplished by violent efforts [vomiting] or by civil war.

(Db) The distinction between internal and external social reproduction has been fully considered. "In internal society the phenomena of generation, either qualitative or quantitative, constitute demography. The individual members, by multiplying or neglecting to do so, indirectly strengthen or weaken society. In the present section we are not concerned at all with this sort of reproduction, but with that of society considered in mass."

In order that there may be reproduction here, it is necessary that one state should generate another by means of reproduction analogous to those in use in the biologic world. One of the most striking cases of reproduction is that of the declaration of independence of a colony, because it may follow the phases of human embryogeny. While the colony remains attached to the mother country, it continues its intrauterine life. The mother country must keep the colony for a long time in process of formation, must make it live by giving it its own life, must often consecrate to the offspring its most precious resources, sometimes without any return, by reason of a premature birth. But when finally a colony is born to autonomous life, when it has become independent, it is not on that account useless to the mother country, any more than a child is to its parents. They remain linked together by the bond of parentage. The race is the same, and the language spoken, which is the outward sign of race, is also identical, the second element being especially durable. Although there is no longer any political connection between England and the United States, the English language will always draw them together. It will be the same with Australia if it becomes independent.

The growth of a colony resembles that of a bud on a plant or a coral. Among the infusoria there is a common mode of subdivision into equal halves. The elliptical body elongates, a constriction is effected. This is paralleled by the division of the overgrown Roman empire into two—the Eastern and the Western—or the separation of Israel and Judah. Secession after conquest, however, is a removal of something discordant which has never been really vitalized, the phenomenon coming under the head of imperfect nutrition as in the case of the unwieldy empires of Alexander and Napoleon.

Finally, there is a form of sexual union among some of the infusoria, where the parents lose their identity in the offspring, which results from their complete union. An analogous union of races gives a descendant one having peculiar characteristics.

“This mixture is often produced by means of conquest, but may be realized in other ways. After conquest vanquished and victors live together and contract alliances. Often it is the vanquished that have the greater influence. This mode of generation recurs periodically in history. The Italian is the child of the German and the Roman; the French people, of the Germans and the Gauls; the Spanish, of the Latin and Gothic races. It is thus that nations are renewed. It is thus that they perish after having procreated descendants. Sometimes the union is voluntary. States are born from immigration, either by the mingling of all sorts of people or of only two; for example, the United States and the Argentine Republic. Sometimes, on the contrary, nations resist such attempts to marry them, and do not produce new nations, but remain celibate. It is thus that the Hungarians and the Slavs, the Irish and the English live side by side without mingling.”

[Manners and customs may be grafted upon an entirely new stock. It is thus that vanquished Rome lives in its system

of laws in all lands where modern civilization reigns, and dead Greece still holds sway in art.]

[We see that it is possible to imagine sexual characteristics in different nations. A conquering nation, by its greater strength simulates the masculine character; but a complete solution of this question of possible sex functions would require a knowledge of the correspondential place of the nation in the Grand Man, or a deeper perception of spiritual principles which rule in the national life than it is possible to obtain by the external method we are here pursuing. Sex is primarily of the spirit. The incompatibility of certain nations, like the infertility of hybrids from perfectly healthy stock, denotes a fundamental lack of affinity. The interior forms of the life force do not interlock. Where there is no union of souls, there is small adaptability in more external offices.]

(Dc) The inter-relations of societies are accomplished by wars, treaties, and alliances. [Conflict is the primal state in nature, unless the advantage to be derived from accommodation may be taught by experience, and until prevented by the supra-social compulsion of a world-wide federation, it must continue to be the rule in the human world. Nowhere is there greater need of a higher standard of morality, than in the dealings of nations with each other. Among people who would scorn a breach of faith by individuals, the like behavior on the part of the nation is overlooked or even applauded. Treaties seldom have coercitive value. Alliances are broken on slight pretexts. The world will not soon forget Germany's characterization of one which she wished to get rid of, as a "scrap of paper!"] "War, although it seems absurd, is therefore the normal international relation." [We might felicitate ourselves upon the superiority of a republic of coequal states to such considerations, did not the Civil War of the United States assure us that the perpetuity of a Union which has arisen from

the need of making common cause in matters of defense, also rests upon the arbitrament of war.]

"When war ends not only in the solution of a dispute, but in conquest or slavery, it passes out of the category of association, and becomes one of nutrition."

"Treaties, either of peace or of commerce, are phenomena of connection; and in default of treaties, usages which are tacit treaties fulfil the same function. Here also must be placed the rights of the people, which are not veritable rights in the coercitive sense of the word." [Although in gross breaches of hospitality, every nation makes common cause with its humblest citizen.]

External "connections are made in the face of many obstacles. Language, which is a connective in internal society, becomes one of the chief preventives of external relations. It is the same with legislation, religion, and many other factors."

(Dd) [In all these phenomena which go to make up national life, we should be blind indeed if we did not recognize the Divine Providence as the source of national power. There is room here for a philosophy of history, and for a recognition of a supreme control of human affairs by eternal ends of good. The rise and fall of nations are but scenes in a divine drama whose plan is too vast for finite comprehension. But although it is not given to man to foresee the future, we may reverently and gratefully recognize the divine leading in past history, and acknowledge that these steps have been necessary for the evolution of the race.]

(E) *Abnormal External Phenomena of Society*

This subject may be considered under five heads, similar to those which have been used in treating of the internal life of society, as follows:

(Ea) *National pathology*: Including injuries from foreign

wars, or from national sins, and the expulsion or repression of the best of the race by religious or political persecution.

(Eb) *National deformities*: Unprogressive character of people, causing inability to share in the common life of the age.

(Ec) *National therapeutics*: Favorable treaties, lucrative enterprises under government control, immigration of desirable citizens from foreign countries.

(Ed) *National hygiene*: Peace conferences, the education of public opinion, and the foundation of a public morality coincident with and resting upon individual regeneration.

(Ee) *Survivals*: For example, national armaments which are a survival of piracy.

(Ea) Nations may suffer internally from the tyranny of an autocrat, or from various forms of disorder which may ensue in disruption; but the diseases which affect society, and which come from without, are usually of the nature of wounds resulting from war, "The loss of a province is a veritable amputation." War indemnities, affecting social nutrition, the loss of citizens, producing social anemia, and sometimes the internal lesion of civil war, growing out of passions aroused in the conflict, remain as direful heritages.

Tariffs are forms of commercial warfare affecting external society. Tariffs have a value which has been very much debated. In any country they are usually used as an enforcing measure against an adversary. The vanquished are not always the greater sufferers from war. The sudden acquisition of unaccustomed wealth has repeatedly proved a snare to the victors. Rome perished from effeminacy and luxury, and the vice engendered thereby. The arrest of development, which strikes certain civilizations (as the Chinese) and which dwarfs them, an excess of officialism, too great predominance of a mere mercantile spirit, militarism, religious fanaticism, which may weaken a nation as a whole, and determine the degree of its

feebleness of a special culture—[all of these affect the well-being of a nation as a whole, and determine the degree of its feebleness or strength in external relations].

Many ancient nations have died, sometimes from the wounds of war, but often because they were unable to adapt themselves to the new life of the coming ages.

(Eb) External deformities of society are like external malformations of the body, which, when congenital, denote some imperfection of the internal tissues, preventing proper reception of the vital fluids, or due nourishment and growth. M. de la Grasserie finds anomalies in external social life where certain races, while inhabiting a land and not prevented from sharing the privileges of its people, choose to remain apart and become political excrescences. Such are the Gypsies, and to some extent the Jews. On the other hand, a peculiar climate may favor the modification of habits and an assimilation into a common type among an assemblage of people of the most diverse nationality, as in the Argentine Republic. As far as a nation fails to share the common life of the age in which it lives, it remains a peculiar and, for that age, a misshapen people, whether the deformity is due to feebleness of national life which lacks power to change and faces approaching dissolution, or whether it results from some national disease or vice which may perhaps be amenable to cure.

(Ec) Statesmen find one of their heaviest burdens in external social therapeutics. The wounds of war must be effaced as far as possible by raising the population to its previous level, and by repairing the money losses by favorable treaties, lucrative enterprises, etc. Other indirect evils may remain. Suffering breeds discontent, and interior lacerations often follow external shocks. Prevention is admitted to be better than a cure, which leads us to the next section.

(Ed) "There is no need to insist on external social hygiene

after what has been said of therapeutic measures. It is sufficient to consider the woes caused by an unfortunate foreign war. They may be repaired, but it would have been better to have prevented them. This can be done, and is done at present by armaments. It is true the remedy is, if not worse, at least almost as bad as the disease. But in the incompletely organized society of the present, where among particular societies there exists no common directive society [nor the wisdom needed for right direction], national armament remains a necessary evil, serving as a remedy much as poisons are used in medicine."

"There are other remedies when interior ills are in question. For example, centralization against secession; or for excessive concentration in its turn, a provincial régime. These are the most efficacious hygienic methods" [in use today, but we may well pause and ask if there are no better ones, and whether the findings of peace conferences are to remain a dead letter until some awful calamity of national strife shall compel attention to the messengers of peace].

[Ancient peoples are sometimes resuscitated, but the new nation is not in this case a resurrection of the old. The form of national life has suffered a complete change. Decrepit nations may, however, survive long after their glory has departed.] "The long existence of the Byzantine Empire was a true survival. The Arabs, after the fall of their empires, still survive ethnically."

"It is the same with institutions. Existing armaments are a survival of piracy, and war indemnities a souvenir of ancient pillage. As to atavic reappearance, it takes place when deeds of cruelty are committed in wars between civilized nations, which is far from being rare."

(F) *Supersocial or Federal Phenomena*

[This degree of national life exists at present only in germ. It is true we have a beginning of international law, and a Hague

Peace Conference, but this latter was powerless to stay the ruthless course of the South African war; and Germany's contemptuous rejection of all good offices looking to the arrest of the World War, showed that the time for wars to cease was not yet. Our modern prophets look with longing eyes to this desire of the nations. Tennyson sings of this vision of the future when at last devastation shall have done its worst—

Till the war-drums throbbed no longer, and the battle
flags were furled

In the Parliament of man, the federation of the world.

[Bellamy* tried to formulate a system of exchanges and a balancing of national accounts on an equitable plan. The Pan-American Congress has struggled with the problem in the effort to unify at least the Western Hemisphere. Out of all this effort and with a slight beginning of a World Court, the great reorganization must eventually be born.

[This highest degree of world-life is the cerebral of the national life, and by its outward exercise, society may enter into its birthright—an earthly kingdom fit for heavenly uses.]

“Federation will produce phenomena of internal order, of central order, and of external order,” [or, in Swedenborg's phraseology (T. C. R., n. 139), “body, soul, and proceeding life” (the soul being the inmost, the body its reciprocal associate, and the life consisting in their conjunction by means of action); and the entire scheme exhibits a complete order of degrees, for as the individual must govern himself, so central society must govern individuals, and the federation control its societies]. “These particular societies play the same role to

* The essential ideas in Bellamy's “Looking Backward” were due to Albert K. Owen's “Integral Coöperation,” with the substitution by Bellamy of Communism in place of coöperation, which was a move in the wrong direction until human nature is quite made over.

each other that the individuals of ordinary societies do. The societies constitute the federation, and when they are observed federatively we obtain the perception of internal federal [or national] phenomena [identical with what we have called "external" social phenomena]. If the federation is considered as a whole in its function of a federal bond, federal cerebral or central powers appear," [and if this unitization includes the whole human race on earth, its action as a unit must be of the highest order, and such as will harmonize with the supreme use of this Earth and its heavens in the Grand Man].

"This comparison enables us to dispense with a detailed description. We only need to say a few words to make these definitions more intelligible. We have left the particular societies in their external aspect in the state of war, this state being able to be replaced only by an almost equally disastrous armed peace, or by the very precarious conventional peace, because no constraint compels the execution of treaties. No coercitive bond exists between societies, no legislation, no real jurisdiction, such as exists between individuals, so long as central cerebral life is not inaugurated in society. Law and jurisdiction can only be when this central life arrives. Simple alliances or neighborly relations are insufficient. It is only in the Society of Societies that this difficulty can find its solution. The federation alone can make laws and judge between them."

"Federation accomplished and possessing in its turn a brain, acts synthetically in the domain of intelligence, of will, and of sentiment—three cerebral faculties which especially belong to it. Its apparent role will be in the domain of will and power."

The foregoing analysis of society by M. de la Grasserie cannot be considered exhaustive. Some departments have been passed over very lightly. What is sometimes called "society,"

meaning the world of fashion, would play a very inferior part in such a scheme as this. Fashion and rules of etiquette, as embodied in leaders of this sort of so-called society, dandies, costumers, hairdressers, and the like, may be likened to the hair which does indeed beautify the person, but has very little vitality. Fashion *may* be distinctly immoral. It can never be more than a superficial covering for society.

The difficulty which attends the plan of federation is the same which assails every great governmental generalization. Plato's conception of the perfect society was that of a complete paternalism in the state. The Guardians were to direct all of the operations of the state down to the least actions of individual members of the commonwealth; for the wisdom of the Guardians was to be unquestioned and the people entirely passive. There could be no progress here. The very object of progress is a nearer approach to an unattainable perfection; but the aristocratic government of the Guardians is really assumed by Plato to be already perfect. Individual initiation among the masses of the people would be discouraged in such a state, and stagnation must result. This fatal flaw in Plato's plan of an ideal "republic" is generally recognized today. Perhaps it may not be so readily admitted that this scheme corresponds biologically to a completely healthy physical man without any soul—an animal automaton, full-blooded and vigorous as to the passions and appetites of the flesh, but spiritually closed to the influx of the heavenly powers. It is the inbreathing of the heavenly auras which vitalizes humanity, and gives the new will to put off the beast and rise into the higher life of the truly human. Compulsory virtue is no virtue at all. Society, like the individual, must have freedom to grow, and the only guardians who can be trusted to guide development without infringing freedom, are the heavenly powers. Society needs government and initiative in mundane

affairs, those centralizing functions of the social brain; but much more does it need influx—the divine leading which is the key to history. Sociology as a natural science may be able to trace resemblances between the body politic and the human organism; but for the completion of this conception something more is needed. There must be the recognition of a commerce between heaven and earth, or a knowledge of the complete correspondence between society, as it exists on earth, and the Grand Man. The revelation of the human form, as exhibited in the spiritual universe, is required as a preliminary to any explanation of the way by which society becomes humanized. We cannot remain satisfied with a deformed or monstrous humanity. If “the whole head is sick and the whole heart faint, from the sole of the foot even unto the head no soundness in it,” (Isaiah I, 5-6), we must call for help upon the Great Physician.

The changes in human society brought about by the great World War must be noticed. Prof. Charles A. Beard of Columbia University says in his “Cross Currents in Europe Today” (p. 202, 1, 3):

The influence of the war upon socialist thought and activity was so deep and so far-reaching that no single phrase may be safely employed to describe it. Undoubtedly division, dissension, and disillusionment were among the outstanding characteristics. But these do not exhaust the subject. During the war all the belligerent governments employed the principles of state socialism on a large scale to obtain the national cohesion and degree of production necessary for carrying on the conflict. In laying taxes, parliaments made distinctions among the various kinds of incomes, which only served to emphasize one of the cardinal points in the socialist indictment of the capitalist order. Organized labor secured a weight in the councils of nations and in the conduct of affairs so great that even the fate of cabinets depended upon its decisions. While labor relaxed its rules and restrictions in the management of industry i

developed ideas and practices of factory control that were new in the history of economy. Trade unionists of the old type, accustomed to consider only hours and wages and equally accustomed to carrying on war against socialistic doctrines, found themselves compelled by the stress of circumstances to accept the idea of compulsory labor and to coöperate more and more with socialist leaders. The German government, long the open foe of the Social Democrats, was forced with the passing months of war to rely more and more upon their support and in the end, it seems, escaped a domestic revolution by relinquishing all authority into their hands. Since the war, naturally, the tide has receded but the old landmarks do not bear just the same aspect.

Human society grows like an individual human being and passes through successive stages of progress. "When a man is being instructed, the progression is from knowledge in the memory to rational truths, afterwards to intellectual truths, and at last to celestial truths." (*Heavenly Arcana*, n. 1495.) We are told something of this progression:

Order is that the celestial shall flow into the spiritual and adapt it to itself; the spiritual will then flow into the rational and adapt it to itself. But when a man is being instructed in first boyhood, the order indeed is then similar, but it appears otherwise, namely that he advances from knowledge in the memory to rational things, from these to spiritual things, and so at last to celestial things. The reason that it so appears, is because the way is thus to be opened to celestial things, which are the inmost. All instruction is simply an opening of the way; and as the way is opened, or what is the same, as the vessels are opened, there thus flow in . . . in order [into the knowledges] rational things that are from celestial spiritual things; into these flow celestial spiritual things; and into these, celestial things. These celestial and spiritual things are continually coming forth, and are also preparing and forming for themselves the vessels which are being opened; which may also be evident from this, that what is of the memory and the reason is in itself dead; and its seeming to live, it has from the inner life which flows in." (*Ibid.*)

The progression from boyhood is this: "Truth learned

belongs to knowledge, rational truth is truth learned, confirmed by reason; intellectual truth is conjoined with internal perception that a thing is so." (*Ibid.*, n. 1496.)

The whole of the progress is conditioned by the reception of interior life.

THE APPLICATION TO CIVILIZATION

Civilization is passing through a similar progressive development. The motive power is the reception of divine life from above through the heavens. This change forms a part of the Second Coming of the Lord Jesus Christ, of which Swedenborg was the appointed herald. He lived toward the end of the Feudal Age and in the transition to, or first beginning of the Capitalistic stage of economic development, himself contributing to its foundation through his treatises on the metallurgy of iron and copper, the first of their kind. The Feudal stage of society represented childhood. Obedience to authority was its keynote. The Capitalistic stage was each man for himself with all the assurance of youth, all of its rivalry and egotism. The Socialistic stage in whose first beginnings we now are, comes from the advent of mass-action, great coöperative movements, the first feeble beginnings of altruism, and the entrance upon the stage of the fully developed powers of adult social life, attended by some climacteric diseases, characteristic of the transition to a new order.

The coming of life of the heavens to earth, the celestial stage, the Commune of Christ, is still more remote. Attempts to have it now are as premature as it would be to expect a youth to suddenly develop the wisdom of age. We must advance one step at a time. When a man "passes into another life, he leaves several things behind, such as cares respecting food, clothing, habitation, and the acquirement of money and wealth,

for in another life there are no such cares." (*Ibid.*, n. 3957.) When the Kingdom of Heaven, which is a kingdom of uses, is established on earth, there will be no need of money, because all will labor from the love of use. But today we still have to have the artificial stimulus of reward for labor in order to induce selfish human beings to undertake work for the world. Hence results money, which represents human labor.

Money, like war, was invented for the sake of dominion, not for heavenly life. We make very little use of our supposed gold standard. Most of the gold slumbers untouched in the treasury vaults. As far as the business transactions inside this country are concerned, we could get along very well by means of a government decree that promissory legal tender notes, issued only by the government, shall represent a certain percentage of the total property of the nation resulting from human labor. The function of the United States Treasury, in this case, is to determine and maintain this ratio with reference to the *entire* people. Private banking and gambling would then be strictly forbidden. All transactions would be on credit, determined on a scientific basis, and money simply a convenience for the exchange of commodities.

The teachings of Jesus distinguish clearly between the heavenly treasures and the riches of earth: "Lay not up for yourselves treasures upon the earth, where moth and rust consume, and where thieves break through and steal; but lay up for yourselves treasures in heaven, where neither moth nor rust doth consume, and where thieves do not break through nor steal; for where thy treasure is, there will thy heart be also." (Matt. VI, 19-21.) Jesus Himself, when upon earth, never accumulated wealth. Whatever funds He and His disciples received from their labors, they put into a common "bag" in the possession of Judas, from which, after their own modest requirements were satisfied, only two expenditures are men-

tioned, to buy something for a religious ceremony, and to give something to the poor. (John XIII, 29.)

How small was their store is evident from the fact that on the approach of the tax-gatherer to Peter the money for the tax was lacking: "And when they were come to Capernaum, they that received the half-shekel came to Peter, and said: Doth not your Teacher pay the half-shekel? He saith: Yea. And when he came into the house, Jesus spake first to him, saying: What thinkest thou, Simon? the kings of the earth, from whom do they receive toll or tribute? from their sons, or from strangers? And when he said: From strangers, Jesus said unto him: Therefore the sons are free. But lest we cause them to stumble, go thou to the sea, and cast a hook, and take up the fish that first cometh up; and when thou hast opened his mouth, thou shalt find a shekel; that take, and give unto them for Me and for thee." (Matt. XVII, 24-27.) Evidently the "bag" was empty, and while Jesus was willing to multiply the loaves and fishes, emblems of heavenly food, He was not willing to descend to the necromancer's art and did not reveal the place of buried treasure.

When the devil showed him "all the kingdoms of the world in a moment of time. And the devil said unto him: To thee will I give all this authority, and the glory of them: *for it hath been delivered unto me*; and to whomsoever I will I give it. If thou therefore wilt worship before me, it shall all be thine." (Luke III, 5-7); Jesus in refusing to yield to the temptation, did not deny the devil's claim that the dominion over the world's riches had been delivered unto him. Why then should *we* seek the reward which the devil is commissioned to give?

To one who wanted to be His disciple, Jesus said: "The foxes have holes, and the birds of the heaven nests; but the Son of man hath not where to lay His head." (Matt. VIII, 20.)

To the rich young man, Jesus said: "If thou wouldst be perfect, go, sell that which thou hast, and give to the poor, and thou shalt have treasure in heaven; and come follow Me." (Matt. XIX, 21.)

Sir Edwin Arnold in his poem, "The Light of the World," represents Jesus as seen from the palaces of the wealthy in words addressed to those in kings' houses, rich in sensuous imagery and obsequious with talk of bended knee and paraphernalia of worship, but less close to the spirit of the Master than Mr. White's, "The Call of the Carpenter," which, though failing to recognize the Divine Man, sees that the Gospel was given to preach deliverance to the captives—deliverance from social injustice.

The Second Coming is to complete that deliverance. It is a coming as Son of *Man*, a coming in a new and renovated *humanity* of the race, wherein shall be social justice.

The final judgment of Babylon and the great battle of Armageddon are still delayed; for the apocalyptic Babylon signifies the false religion of those who are in the lust of "dominion over the souls of men, to the end that they may be worshiped as gods and may alone possess the goods of the whole world." (*Apocalypse Revealed*, n. 753); and this no matter whether they call themselves "Roman Catholic," or "Protestant," or "Agnostic"; because the Lord sends the exhortation: "Come out of her, my people, that ye be not partakers of her sins, and that ye receive not of her plagues,"—"to all, as well those who are not in it, to beware of conjunction with it by acknowledgement and affection, lest as to their souls they should be conjoined to its abominations, and should perish." (*Ibid.*, n. 760.) Therefore, in the coming judgment of those who desire that they "may alone possess the goods of the whole earth," we are especially warned against this terrible lust of dominion.

"Only employers, trades-people, property owners, and usurers go to church. . . . The religious world with its organizations is something far removed from the labor world with its organizations. The two are drifting farther apart from each other every year," says Mr. White.

"Thou shalt not countenance a poor man in his dispute," says the law of Moses, (Exodus XXIII, 6), a sentiment much commended by wealthy pew-holders; but they forget that the law of Moses also commanded that there should be a redistribution of land every fifty years, whereby there could be a fresh start with equal opportunities for all. (See Leviticus, Chapter XXV.) This truly socialistic arrangement would not be practicable in our present complex civilization; but then it must have done much to lessen the distinction between rich and poor, somewhat alleviating the seeming harshness and injustice of the above warning not to countenance the cause of a poor man, which signifies in the internal sense that the falses of those who are spiritually "poor," or ignorant of the truth, ought not to be favored. If people started with a square deal, or according to the principles of the "four-square city," only the idle or the vicious would ever be likely to come to want. The "poor man" that ought not to be favored is this false doctrine, that the earth may belong to a few favored ones.

The question of justice now naturally arises, and the inquiry passes into the field of ethics. An investigation of the nature and basis of property shows that there is *a fundamental and irreconcilable difference between property in things which are the product of labor and property in land*; that the one has a natural basis and sanction while the other has none, and that the recognition of exclusive property in land is necessarily a denial of the right of property in the products of labor. Further investigation shows that private property in land always has led and always must, as development proceeds, lead to the enslavement of the laboring class; that land-owners can make no just claim

to compensation if society choose to resume its right; that so far from private property in land being in accordance with the natural perceptions of men, the very reverse is true, and in the United States we are already beginning to feel the effects of having admitted this erroneous and destructive principle. The inquiry then passes to the field of practical statesmanship. It is seen that private property in land, instead of being necessary to its improvement and use, stands in the way of improvement and use, and entails an enormous waste of productive forces; that the recognition of the common right to land involves no shock or dispossession, but is to be reached by the simple and easy method of abolishing all taxation save that upon land-values. And an inquiry into the principles of taxation, shows land-values to be, in all respects, the best subject of taxation. A consideration of the change proposed then shows that it would enormously increase production; would secure justice in distribution; would benefit all classes; and would make possible an advance to a higher and nobler civilization. . . . Progress, always kindled by association, always passes into retrogression as inequality is developed. (Henry George, "Progress and Poverty," Fourth Edition, pp. 3-4.)

As in a separated state the whole powers of man are required to maintain existence, and mental power is only set free for higher uses by the association of men in communities, which permits the division of labor and all the economies which come with the coöperation of increased numbers, association is the first essential of progress. Improvement becomes possible as men come together in peaceful association, and the wider and closer the association the greater the possibilities of improvement. And as the wasteful expenditure of mental power in conflict becomes greater or less as the moral law which accords to each an equality of rights is ignored or is recognized, equality (or justice) is the second essential of progress. (*Ibid.*, p. 363.)

Equity, or justice, is the thing to strive for. "When Egypt went down, three per cent of her people owned ninety-seven per cent of her wealth. The working people starved to death. When Babylon went down, two per cent of the population owned all the wealth, and again the people were starved.

When Rome went down, 1,800 men owned the world. Now here are the figures of the United States: In 1850 capital owned thirty-seven per cent of the nation's wealth. In 1879 capital owned sixty-three per cent. In 1880, seventy-six per cent." (A. K. Owen, in "Integral Coöperation at Work," p. 199.)

With the perfection of a highly organized mode of production by great masses of men, provided with complex machinery which can only be used by many men working together as a unit, and with the substitution of the giant forces of nature, harnessed to our car of progress, in place of the puny strength of human muscles, the Capitalistic stage of society becomes an anachronism, just as the Feudal stage became an anachronism and had to be superseded by the era of Capital at about the time when Swedenborg lived.

Under the dominant social system the processes of production tend more and more to be carried on collectively. This makes for economy and fosters trusts. These are inevitable, but the tendency is for ownership and direction of large enterprises to become hereditary, instead of which directors should come up from the ranks, rich in experience, and ownership should be vested in the whole, by some kind of coöperation or profit-sharing.

Swedenborg thought that the reason why the Hollanders were so prosperous was on account of their republican form of government. Another reason may be because their constant danger of invasion by the sea compels them to cultivate coöperative effort. In a sense, their land is a product of labor and does not so much come under Henry George's fundamental divergence between two sorts of property.

Swedenborg's doctrine of the Grand Man more especially applies to the complex of the heavenly societies which receive their life from the Lord. It cannot exist on earth except, or

to the extent, that equity, or justice reigns. The heart throb of the Grand Man must be the love of the neighbor or heavenly charity which embraces justice.

The universal angelic heaven, together with the church, is before the Lord as one Man; in like manner a society consisting of thousands of angels. The universal heaven, and also a whole society in heaven, can, at the good pleasure of the Lord, appear as a Man, great or small, as a giant or as an infant; and yet what so appears is not the angels but it is the Divine that is in them. That God is Man, is the sole cause from which heaven and the church are a Man, in the concrete or complex, greater, lesser, and least; and hence the proceeding Divine, which is the Divine from Him, is similar in everything least and greatest which is man. (*Apocalypse Explained*, n. 1222.)

All who are in love to the Lord and in charity towards the neighbor, and who do good to him, and who have a conscience of what is just and fair, are within the Grand Man; for they are in the Lord, and therefore in Heaven; but all who are in the love of self and the world, and thence in concupiscences, and only do what is good on account of the laws, self-honor, the wealth of the world and reputation thence; thus who are interiorly unmerciful, in hatred and revenge against the neighbor for the sake of self and the world, and are delighted at his misfortunes when he does not favor them, are outside the Grand Man, for they are in Hell. These do not correspond to any organs and members in the body, but to the various vitiations and diseases induced on them. (*Heavenly Arcana*, n. 4225.)

ADDENDUM

An Important Incident. One of Swedenborg's Memorable Relations Wherein He Was Permitted to Instruct the Angels. (Conjugal Love, n. 326-329.)

Though it may seem to have little connection with what precedes, that which follows is essential to a correct comprehension of Swedenborg's thoughts.

After the problem concerning the soul had been discussed and solved in the public school [where youths are instructed in the spiritual world], I saw them coming out in order: first came the head master, then the elders, in the midst of whom were the five young men who had given the answers, and after these the rest. When they were come out they went apart to the environs of the house, where there were walks enclosed with shrubs; and being assembled, they divided into small crowds, forming so many groups of young men conversing together on subjects of wisdom; in each group there was one of the men from the orchestra.

As I saw these from my lodgings, I became in the spirit, and in the spirit I went out to them, and approached the head master, who had lately proposed the problem about the soul.

On seeing me, he said, "Who are you? I was surprised as I saw you approaching in the way, that at one instant you came into my sight, and the next instant went out of it; or that at one time I saw you, and suddenly I did not see you; assuredly you are not in the same state of life that we are."

To this I replied, smiling, "I am neither a player nor a Vertumnus; but I am alternate, at one time in your light, and at another in your shade; thus both a foreigner and a native."

Hereupon the head master looked at me, and said, "You speak strange and wonderful things; tell me who you are."

I said, "I am in the world in which you have been, and from which you have departed, which is called the natural world; and I am also in the world into which you have come, and in which you are, which is called the spiritual world. Hence it is, that I am in the natural state, and at the same time in the spiritual state with you; and when I am in the natural state, you do not see me, but when I am in the spiritual state, you do. That I should be such, has been given me by the Lord. It is known to you, enlightened man, that a man of the natural world does not see a man of the spiritual world, nor contrariwise; wherefore when I let my spirit into the body, you did not see me. You have been teaching in the public school exercises, that you are souls, and that souls see souls, because they are human forms; and you know, that when you were in the natural world, you did not see yourselves or your souls in your bodies; and this is a consequence of the difference between what is spiritual and what is natural."

When he heard of the difference between what is spiritual and what is natural, he said, "What is that difference? Is it not like the difference between what is more and less pure? Consequently, what is the spiritual but a purer natural?"

I replied, "The difference is not such; but it is like that between what is prior and posterior, between which there is no determinate ratio; for the prior is in the posterior as the cause is in its effect; and the posterior is from the prior as the effect from its cause; hence it is that one does not appear to the other."

To this the head master said, "I have meditated and ruminated on this difference, but heretofore in vain; I wish I could perceive it."

I said, "You shall not only perceive the difference between

what is spiritual and what is natural, but you shall also see it." I then proceeded as follows: "You yourself are in the spiritual state when with your associates, but in the natural state with me; for you speak with your associates in the spiritual language, which is common to every spirit and angel, but with me you speak in my mother tongue; for every spirit and angel, when speaking with a man, speaks the man's own language; thus French with a Frenchman, English with an Englishman, Greek with a Greek, Arabic with an Arab, and so forth. In order, therefore, that you may know the difference between what is spiritual and what is natural in respect to language, make this experiment: withdraw to your associates, and say something there; then retain the expressions, and return with them in your memory, and utter them before me."

He did so, and returned to me with those expressions in his mouth, and uttered them; and he did not understand one of them; they were altogether strange and foreign, such as do not occur in any language of the natural world. By this experiment, several times repeated, it was made very evident, that all in the spiritual world have the spiritual language, which has nothing in common with any language of the natural world, and that every man comes of himself into that language after death. At the same time also he experienced, that the very sound of the spiritual language differs in such a degree from the sound of natural language, that a spiritual sound, although loud, cannot be heard at all by a natural man, nor a natural sound by a spiritual man.

Afterwards I requested the head master and the bystanders to withdraw to their associates, and write some sentence on a piece of paper, and then return with it to me, and read it. They did so, and returned with the paper in their hand; but when they read it, they could not understand any part of it, because the writing consisted only of some letters of the alphabet, with

strokes over them, each of which was significative of some particular meaning; because each letter of the alphabet is significative of some particular meaning there, it is evident whence it is that the Lord is called the Alpha and the Omega. On their repeated withdrawing, writing, and returning to me, they found that that writing involved and comprehended innumerable things which no natural writing could possibly express; and they were told that this was because the spiritual man thinks of things which are incomprehensible and ineffable to the natural man, and that these things cannot flow in and be brought into any other writing nor into any other language.

Then as the bystanders were unwilling to comprehend that spiritual thought so far exceeds natural thought as to be respectively ineffable, I said to them, "Make the experiment; withdraw into your spiritual society, and think something, and retain it in your memory, and return and express it before me."

They did so; they withdrew, thought something, retained their thoughts, and again came forth; but when they wanted to express the thing they had thought, they were unable; for they did not find any idea of natural thought adequate to any idea of spiritual thought, consequently no words expressive of it; for ideas of thought become the expressions of speech.

Then again they withdrew and returned, and they were convinced that spiritual ideas are supernatural, inexpressible, ineffable, and incomprehensible to the natural man; and on account of this their super-eminence, they said, that spiritual ideas or thoughts respectively to natural ones were ideas of ideas, are thoughts of thoughts; and that therefore they were expressive of qualities of qualities, and affections of affections; consequently that spiritual thoughts were the beginnings and origins of natural thoughts. Hence also it was made evident that spiritual wisdom is the wisdom of wisdom, and consequently imperceptible to any wise man in the natural world.

It was then told them from the third heaven, that there is a wisdom still more interior and higher which is called celestial, bearing a proportion to spiritual wisdom like that which spiritual wisdom bears to natural; and that these flow in in order according to the heavens from the Divine wisdom of the Lord, which is infinite.

After this I said to the bystanders, "You have seen from these three experimental proofs what is the difference between what is spiritual and what is natural, and also the reason why a natural man does not appear to a spiritual man, nor a spiritual man to a natural one, although they are consociated as to affections and thoughts, and therefore as to presence. Hence it is that, as I was approaching you—the head master—at one time you saw me, and at another you did not."

After this, a voice was heard from a higher heaven, saying to the head master, "Come up hither"; and he went up. And on his return, he said that the angels, like himself, had not previously known the difference between what is spiritual and what is natural, because there had not before been given an opportunity of comparing them together, by any man's being in both worlds at the same time; and without comparison these differences are not known.

After this we retired, and speaking again on the subject, I said, "Those differences exist from no other source than the fact that you, who are in the spiritual world, and who consequently are spiritual, are in substantial things and not in material things; and substantial things are the beginnings of material things. You are in principles and thus in singulars; but we are in principates and composites; you are in particulars, but we are in generals; and as generals cannot enter into particulars, so neither can natural things, which are material, enter into spiritual things which are substantial, any more than a ship's cable can enter into, or be drawn through, the eye of a

sewing needle; or than a nerve can enter or be let into one of the fibrils of which it is composed. This also is known in the world; therefore the learned are agreed, that there is no influx of what is natural into what is spiritual, but of what is spiritual into what is natural. This now is the reason why a natural man cannot think that which a spiritual man thinks nor consequently express them; wherefore Paul calls what he hears from the third heaven unspeakable. [2 Cor. XII, 14.] Add to this that thinking spiritually is thinking apart from space and time, and that thinking naturally is thinking with space and time; for to every idea of natural thought there adheres something from time and space, which is not the case with any spiritual idea; the reason is, that the spiritual world is not in space and time, like the natural world, but in the appearance of space and time. In this respect also spiritual thoughts and perceptions differ from natural ones. Wherefore you are able to think of the essence and omnipresence of God from eternity, that is, of God before the creation of the world, since you think of the essence of God from eternity apart from time, and of His omnipresence apart from space, and thus comprehend such things as transcend the ideas of the natural man."

I then related that I had once thought of the essence and omnipresence of God from eternity, that is, of God before the creation of the world; and that because I was not as yet able to remove spaces and times from the ideas of my thought, I became anxious; for there entered the idea of nature instead of God; but it was said to me, "Remove the ideas of space and time, and you will see." It was given me to remove them, and I saw; and from that time I was able to think of God from eternity, and not at all of nature from eternity; because God is in all time apart from time, and in all space apart from space, whereas nature is in all time in time, and in all space in

space; and nature with its time and space, must of necessity have a beginning and an origin, but not God, Who is apart from time and space; wherefore nature is from God, not from eternity, but in time, that is, together with its own time and space.

After the head master and the rest had left me, some boys who had been in the public school exercises, followed me home, and stood near me for a little while as I was writing; and lo, they then saw a cockroach running upon my paper, and asked in surprise what the name of that nimble little creature was. I said, "It is called a cockroach; and I will tell you some wonderful things about it. This little living thing contains in itself as many members and viscera as there are in a camel, such as brains, hearts, pulmonary pipes, organs of sense, motion, and generation, a stomach, intestines, and many others; and each of these of still purer parts which escape the observation of the keenest eye."

They then said that this little living thing nevertheless appeared to them as but a simple substance.

To this I said, "There are nevertheless innumerable things within it. I say these things in order that you may know that the case is similar in regard to every object which appears before you as one, simple and least, both in your actions and in your affections and thoughts. I can assure you that every grain of thought, and every drop of your affection, is divisible *ad infinitum*; and that in proportion as your ideas are divisible, so you are wise. Know then, that everything divided is more and more manifold, and not more and more simple; because what is divided again and again approaches nearer and nearer to the infinite in which all things are infinitely. What I am now telling you is new and heretofore unheard of.

[This is the first announcement of the doctrine of potentization. Certain substances, ordinarily inert, receive increased or

peculiar efficacy, when administered in a state of minute subdivision.

This Hahnemannian principle, confirmatory of Swedenborg, has been verified by Jaeger who, using a Hipps chronoscope, found that powerful drugs exhibited their effects much more quickly when administered in high dilution, possibly on account of ionization. This result has been accepted in Germany, France, and Scandinavia, but seems to be hardly known as yet in England and America.]

When I had said this, the boys took their leave of me, and went to the chief teacher, and entreated him to propose some time or other in the public school something new and unheard of as a problem.

He inquired, "What?"

They said, "That everything divided is more and more manifest, and not more simple; because it approaches nearer and nearer to the infinite, in which all things are infinitely."

So he promised to propose it, and said, "I see this, because I have perceived that one natural idea is the continent of innumerable spiritual ideas; yea, that one spiritual idea is the continent of innumerable celestial ideas. Hence comes the difference between the celestial wisdom in which the angels of the third heaven are, and the spiritual wisdom in which the angels of the second heaven are, and also the natural wisdom in which the angels of the ultimate heaven, and likewise men, are."

